DEVELOPING NON-TECHNICAL AIRCRAFT AUTOMATION MANAGEMENT SKILLS: FIRST STEPS IN AN ORGANIZATIONAL INTERVENTION

by
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ABSTRACT

The purpose of this study was to address a gap in training by providing a professional development program designed to provide corporate flight instructors information about non-technical aircraft automation management skills while, simultaneously, positively affecting their perceptions of the corporate education organization for which they work. Using organizational systems theory as a theoretical framework, it was hypothesized that the program would increase flight instructor knowledge about these non-technical skills, increase their teacher self-efficacy, improve their perceptions about the organization's functioning as a learning organization, and contribute to their perceptions of organizational support. Delivered by seminar and through a book of best practices, the intervention components included social learning theory and its applicability to airmanship development, pilot monitoring skills, automation monitoring skills, and cockpit workload in a technically advanced aircraft. Statistical analyses indicated that the intervention did produce statistically significant increases in knowledge, but not in overall teacher self-efficacy or in overall learning organization functioning. There was a statistically significant increase in the organization's use of concrete learning practices and processes, a learning organization sub-scale. Additionally, learning organization functioning contributed significantly to the prediction of perceived organizational support. Implications of these findings are presented, along with methodological limitations and future research directions.

ACKNOWLEDGEMENTS

My passion for flying is as strong as my passion for learning and, interestingly, I have found many similarities between learning to fly and conducting dissertation research. Just as a new flight student will likely face certain disaster without a talented and skilled flight instructor by their side, so too will a doctoral student without a talented and skilled adviser. It is with this in mind that I would like to express my deepest appreciation to Dr. Christine Eith, my Dissertation Adviser. Her expert advice, strategic guidance, patience, and support made this research possible.

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EXECUTIVE SUMMARY

The introduction of new technologies in education organizations is not unusual. The effects of new technologies and their impact on curricula can, however, profoundly affect the teachers expected to implement them by influencing their attitudes about the changes (Wierenga, Kamsteeg, Simons & Veenswijk, 2015). Perhaps more importantly, these changes may affect teachers' perception of their abilities, and these perceptions can influence their willingness to implement the changes (Roehrig, Kruse & Kern, 2007), especially if they need to change their knowledge (Cerit, 2013).

One such technology change implemented within an educational organization formed the impetus for the following research. Specifically, after more than two decades of teaching military initial entry helicopter flight students to fly using a non-modernized, 100% hand-flown aircraft, the military introduced a technically advanced and highly automated helicopter as its initial entry training aircraft. Through this change, the corporate organization contracted by the military to provide this flight training, hereafter referred to as RWFT, needed to adapt. More precisely, this new training aircraft necessitated a change in flight instructor skill and knowledge because flying a technically advanced aircraft is significantly different than flying a non-modernized aircraft and completely changes the workload in the cockpit (Dahlstrom, Dekker, & Nahlinder, 2006). Stated another way, technically advanced aircraft require pilots to seamlessly transition between basic technical flying skills and non-technical aircraft automation management skills and, in the case of flight training in a technically advanced aircraft, flight instructors should also be able to teach these technical and non-technical skills (International Federation of Airline Pilot Associations, 2012).

The Purpose of the Research

Despite the cockpit workload change inherent in flying technically advanced aircraft, strategies to teach pilots to fly have remain unchanged for decades (Lindo, Deaton, Cain & Lang, 2012). Concerned about the impact that this flight training paradigm shift had on RWFT flight instructors, the author, in his capacity as the leader of RWFT, initiated a program of organizational improvement focused on ensuring that RWFT's flight instructors were optimally prepared to teach flight students using this new aircraft. Beginning with a needs assessment that informed the development of an organizational intervention, this project focused on increasing flight instructor awareness and knowledge of the importance of non-technical skills while, simultaneously, enhancing their overall perceptions of RWFT's organizational functioning.

Needs Assessment

Needs assessment research sought to collect data associated with RWFT flight instructors' teacher self-efficacy (Tschannen-Moran, Hoy, & Hoy, 1998), attitudes toward aircraft automation (Naidoo & Vermeulen, 2014), perceptions about the training they received in preparation for teaching students in the new aircraft (United States Army Aviation Center of Excellence, 2016), and perceptions about RWFT's functioning as a learning organization (Garvin, Edmondson, & Gino's, 2008; Kontoghiorghes, Awbrey, & Fuerig, 2005). Results suggested that, while RWFT flight instructors did not appear to have any negative opinions about the new training aircraft, they felt that the training they received as they prepared to teach students to fly this technically advanced aircraft was poorly sequenced, too rushed, and lacked information on how to teach flight students, particularly the non-technical aircraft automation management skills. Additionally, flight instructors expressed generally negative attitudes about RWFT as an organization and indicated that they felt unsupported by the company since they were not able to participate in valuable training activities. Finally, flight instructors generally indicated a positive level of teacher self-efficacy, although it appeared that their individual sense of their personal teaching efficacy was stronger than their general teaching efficacy, which is influenced by external factors (Tschannen-Moran et al., 1998).

Reconciling the Gap in Training

Based on these results, an intervention envisioned to address the gaps identified in flight instructors' qualification training, and to reconcile their dissatisfaction with RWFT, was developed. The intervention model assumed that by providing a relevant and applicable professional development program, the flight instructors would not only be better prepared to teach students to fly in a technically advanced aircraft, but also that they would experience an improved perception of RWFT as an organization. Specifically, the program components included topics such as social learning theory (Bandura, 1986) and its applicability to airmanship development (Ebbage & Spencer, 2004), pilot monitoring skills, automation monitoring skills, and cockpit workload in technically advanced aircraft (IFALPA, 2012). Expected outcomes included increased knowledge about the non-technical skills, an enhanced pedagogical ability to teach the skills (Shulman, 1986; Van Driel & Berry, 2012), and increased levels of perceived organizational support (Bartlett, 2001; Eisenberger, Huntington, Hutchison, & Sowa, 1986; Ehrhardt, Miller, Freeman, & Hom, 2011).

The Intervention

Using a fixed method, sequentially timed, explanatory design (Creswell & Plano Clark, 2011), the intervention components were delivered in two ways, namely through a training seminar during an organization-wide Safety Stand-down day and through the dissemination of a book of best practices. Process evaluation focused on the quality of materials provided, engagement in seminar content, and preparedness of the facilitators. Outcome evaluation focused on determining whether the intervention affected participant knowledge about the non-technical skills, whether the intervention affected teacher self-efficacy, whether the intervention affected perceptions of RWFT's functioning as a learning organization, and perceptions of Perceived Organizational Support.

Findings

Process evaluation suggested that the implementation of the intervention was acceptable, since data revealed very high levels of satisfaction with the training materials, the facilitators' knowledge, and the overall quality of the seminars. Outcome evaluation, on the other hand, suggested that little had changed with respect to teacher self-efficacy or perceptions of RWFT functioning as a learning organization. The use of concrete learning practices and processes, however, did demonstrate a statistically significant increase, suggesting that RWFT flight instructors had begun to feel that RWFT collects information from its stakeholders, analyzes its findings, and ensures that its employees are able to participate in valuable training activities (Garvin et al., 2008; Kontoghiorghes et al., 2005). Finally, Perceived Organizational Support results suggested that flight instructors generally felt, although not strongly, that RWFT valued their contributions to organizational success and cared about their well-being (Eisenberger, et al., 1986). Hierarchical linear regression revealed that the prediction of a flight instructor's perceived organizational support was significantly improved by learning organization functioning, especially through a supportive learning environment.

Conclusions

While there were positive results in terms of knowledge increase, there was relatively little effect on the organizational outcome variables or the teacher efficacy variables, statistically.

Based on multiple sources of organizational turbulence, including significant training aircraft shortages and multiple changes to the flight training syllabus, however, it appeared that RWFT navigated a period of organizational upheaval relatively well. Since trust is significantly related to perceived organizational support (Eisenberger et al., 1986), and since organizational turbulence often destroys an employee's trust in an organization (Lines, Selart, Espedal & Johansen, 2005), communicating openly with employees and involving them in the change process is essential for preserving trust (Morgan & Zeffance, 2003). Based on the results suggesting that RWFT improved its use of concrete learning practices and processes, it is reasonable to conclude that RWFT management either built or maintained employee trust throughout the upheaval. To further elucidate these findings, however, additional qualitative research should follow.

CHAPTER 1: INTRODUCTION TO THE PROBLEM OF PRACTICE

Chapter Overview

This chapter introduces the problem of practice resulting from the recent introduction of a technically advanced aircraft (TAA) into a U.S. Armed Force's initial helicopter pilot training program. Specifically, it addresses the ways in which this new training helicopter may have affected the flight instructors employed by a non-military corporate rotary wing flight training organization, hereafter referred to as "RWFT," contracted by the government to provide this training. In addition to providing background information about this change to flight training, this chapter provides an orientation into the networked system of the initial helicopter pilot training program. Through the lens of social cognitive theory and teacher self-efficacy, this chapter suggests how significant curriculum change, attitudes toward aircraft automation, and organizational aspects such as culture, learning, and leadership may have impacted the flight training program. By providing a framework for understanding the implications of teaching student pilots how to fly in a technically advanced helicopter, variables impacting this problem of practice are operationalized. Based on the discussion of these concepts, the rationale for a needs assessment exploring the flight training curriculum, the instructor qualification training, and the organization itself emerges.

Background

Originating in 1953, the Army established its Aviation School in order to ensure that its aviation community learned its unique aviation tactics and techniques (Weinert, 1991). During the Vietnam conflict, the need for helicopter pilots grew significantly and since that time, every aviator learned to fly helicopters through attending the Initial Entry Rotary Wing (IERW) course (Dohme, 1995). This flight training course continues today and its unabated student throughput has earned the training site the distinction as the single largest helicopter flight school worldwide (Dohme, 1995).

The Budget Control Act of 2011 required the U.S. Army to develop a plan to reduce costs, particularly the costs associated with aviation (Headquarters Department of the Army [HQDA], 2015). This cost-cutting plan, known as the Aviation Restructure Initiative, required the Army to divest itself of all single-engine, non-modernized helicopters (HQDA, 2015). Subsequently, after more than twenty years as the Army's training aircraft, the single-engine Bell TH-67 Creek helicopter was to be replaced by the technically advanced, dual-engine Airbus UH-72A Lakota (HQDA, 2015).

Significantly different than the non-modernized TH-67 Creek that requires the pilot to constantly fly the aircraft manually, the Lakota, a technically advanced aircraft, is capable of *hands off* flying based on its automated flight control systems (United States Army Aviation Center of Excellence [USAACE], 2015). In fact, its flight control systems can make instantaneous control inputs to maintain aircraft stability (Airbus Helicopters, 2016). Despite the associated workload decrease resulting from computer operated actuators that move, or maintain, flight controls (Airbus, 2016), a new pilot learning to fly with these systems may not gain the experience of feeling and sensing the conditions that require appropriate flight control inputs. Perhaps as important, the Lakota is prohibited from conducting some basic maneuvers such as the touchdown autorotation (Airbus, 2016), long considered a mainstay in Army rotary wing flight training (Dohme, 1995).

As the divestment of the TH-67 was to occur over several years, cohorts of flight students would learn to fly in either the non-modernized Bell TH-67 or in the technically advanced Airbus UH-72 until the training fleet is purely UH-72 (HQDA, 2015). Specifically, the first class of UH-72A students began training in January 2016 and by fiscal year 2018, 75% of flight students will have learned to fly in the Lakota (Osborne, 2017). Based on the different capabilities of each helicopter, flight students will gain exposure to different flight training content, depending on the training aircraft in which they learn (USAACE, 2015). Collectively, these different capabilities combine to illuminate a potential problem of practice suggesting that pilots who receive their initial entry rotary wing flight training in the advanced aircraft will not have the same skills as those trained in the older aircraft, especially manual hand flying skills.

According to the Federal Aviation Administration (FAA), helicopter flight instructors should stress to their students that flying a helicopter requires coordination through the synchronization of hands and feet at the right magnitude and amplitude in order to make the machine fly (FAA, 2012). In developing the coordination and manual hand flying skill, students will begin to sense the degree of pressure and the amount of displacement required, in order to make the inputs at the right time to ensure a smooth flight (FAA, 2012). Despite this, the US Army offers that "the legacy 'hand flying' skills that were required of older unstabilized aircraft are now more appropriately relegated to dealing with failure modes" (USAACE, 2015, p. 10) and since technically advanced aircraft have redundant systems, proficiency in failure modes is unnecessary and cost prohibitive (USAACE, 2015). Manual flying skills, however, remain critical for pilots, especially during emergency situations.

Citing multiple accidents and mishaps involving modern aircraft equipped with advanced navigation and autopilot systems, the erosion of a pilot's manual flying skill may contribute to an inability to recover an aircraft when these advanced systems fail (FAA, 2016). In fact, the FAA and aircraft manufacturers alike, including Airbus, continue to stress the need for pilots to immediately return to hand flying their aircraft when automation fails (Airbus Helicopters, 2016;

FAA, 2016). This need to revert to hand flying, however, presupposes that pilots have the appropriate manual flying skills in their aviation repertoire. If these flight students never learned to fly without automation during their initial training, then they may be disadvantaged if and when these failures occur. It is through this paradoxical situation that the problem of practice emerges.

On the surface, it might appear that simply allowing the students to fly without the aid of automation would reconcile the inability to fly manually. Flying technically advanced aircraft, however, is very different from flying non-modernized aircraft because the technology completely changes the cockpit workload (Dahlstrom, Dekker & Nahlinder, 2006). Therefore, the introduction of the UH-72A as the training aircraft has implications for not only the flight students, but also the flight instructors.

Since 1994, flight instructors employed by RWFT, a 375+ person corporate organization led by the author and contracted by the government to provide IERW flight training, have taught more than 1200 students per year to fly using the TH-67. The divestment of the TH-67 and the introduction of the UH-72A Lakota, however, ushered in a new era of flight training whereby initial entry students are exposed to highly automated aircraft systems (HQDA, 2015). Organizationally, the requirement for flight instructors to adapt in order to meet the demands of the new aircraft, effectively altering decades of very predictable flight training, may create significant turbulence within the organization (Oreg & Berson, 2011). Issues such as resistance to technology (Leonardi, 2009), a reluctance to adopt new training strategies after decades of teaching flight students a certain way, ineffective training for instructors, and curriculum issues within the IERW program itself may undermine the flight instructors' ability to teach and ultimately impact the flight training outcomes of their students.

Problem Statement

Despite concerns associated with the erosion of manual flying skill due to over-reliance on aircraft automation (FAA, 2016), the military has introduced a technically advanced helicopter, with limited ability to fly without automation, as its initial training aircraft (HQDA, 2015). Subsequently, flight students trained in the UH-72A and exposed to its reliance on automation may have little, if any, opportunity to fly without automation during their initial training, placing them at a disadvantage if and when these failures occur. Therefore, it is necessary to ensure that the flight instructors who are responsible for teaching the changed curriculum are optimally poised to develop within their students both the manual flying skill expected of pilots (Airbus Helicopters, 2016; FAA, 2016) and the ability to function effectively with and without the aid of automation.

The Rotary Wing Flight Training Networked System

Prior to synthesizing and reviewing the literature that may illuminate the factors associated with this problem of practice, it is useful to understand the complex system of interactions operating within the military's rotary wing flight training program. Using concepts from Neal and Neal (2013), the initial training and education of a military aviator can be conceptualized as a networked system (see Figure 1). Through an understanding of this system, and those systems that interact directly with the aviator-in-training, it becomes possible to identify those factors that may actually be actionable.

While participating in flight training, students experience multiple interactions throughout their experience. From the flight student's administrative microsystem involving their military chain of command, peers, and mentors alike, to the flight student's school microsystem involving RWFT, flight students learn to fly based on direct instruction from academic instructors and flight instructors who are managed within the contract flight training exosystem. Receiving guidance, policy, and direction from the military leadership within the flight training exosytem, the contract flight training exosystem implements guidance and policy from the military leadership. Through this implementation, the flight student interacts within the mesosystem shaped by both the military policy and RWFT, including the recently changed curriculum involving the newly introduced technically advanced aircraft.

Although this networked system associated with flight training is complex, the most basic interaction within this network exists between the individual flight student and his or her flight instructor. It is with this interaction in mind that an understanding of how this highly automated training helicopter, and the flight training curriculum utilizing it, affects this interaction. Perhaps more importantly, from the perspective of the flight instructors who are implementing this flight training curriculum using the new aircraft, the factors associated with the problem of practice will become clear.

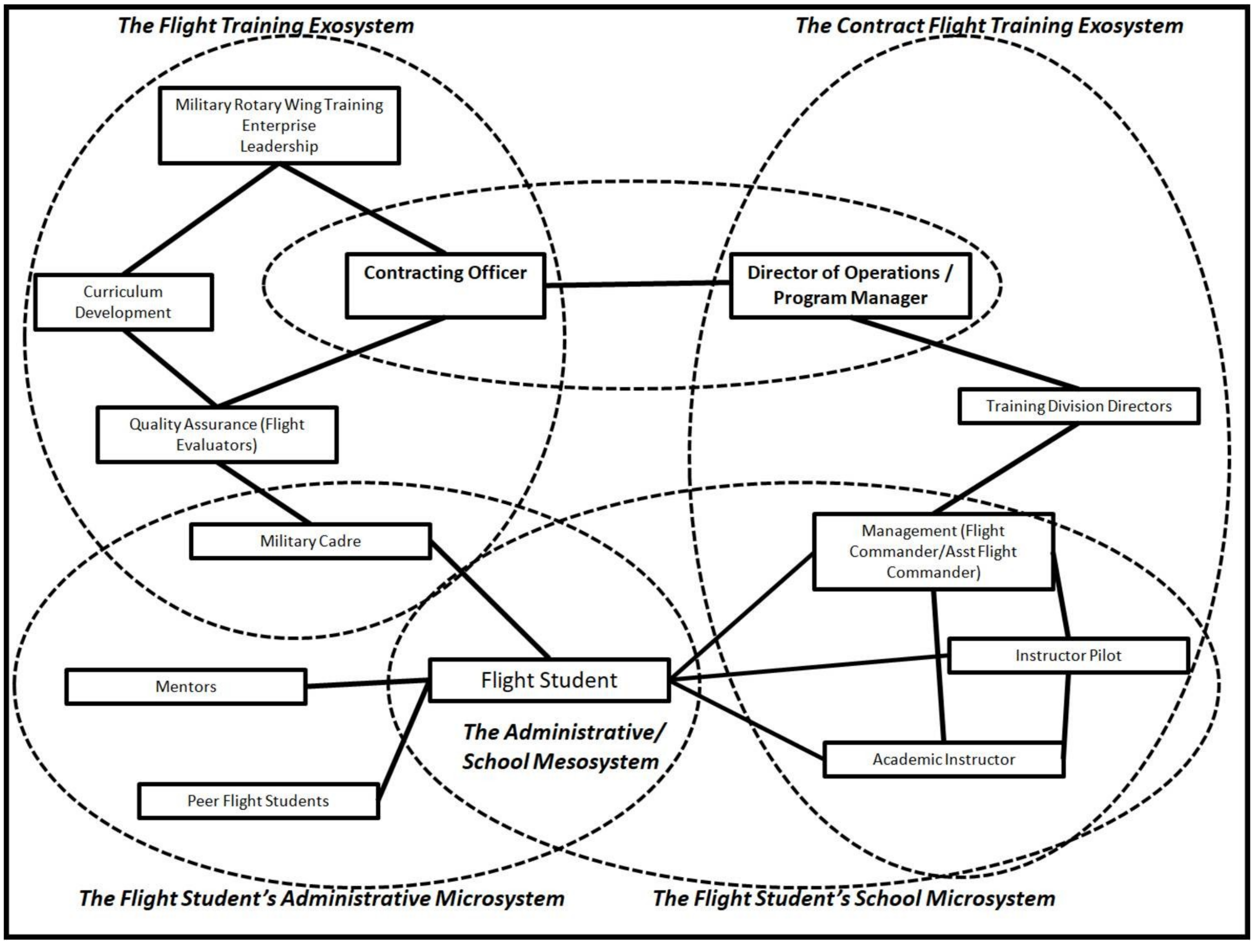

Figure 1. Flight Student's Ecological System Network

Theoretical Framework

The interaction between the flight student and the flight instructor forms the basis of flight training and, regardless of the aircraft flown, strategies to teach new pilots to fly have remained virtually the same for decades (Lindo, Deaton, Cain, & Lang, 2012). Flight training is based on social interaction and the importance of this interaction cannot be overstated since the instructor will likely spend many hours with the student, inside the cockpit and inside the classroom, ensuring that the student has acquired both the skills and the knowledge required to earn a flying certification (FAA, 2008). With this in mind, Bandura's (1986) social cognitive theory serves as a useful theoretical framework for more deeply understanding the factors associated with the introduction of a technically advanced helicopter as an initial training aircraft.

The social cognitive perspective focuses on the learning that occurs within a social context and among Bandura's (1986) tenets, observational learning and self-efficacy are particularly salient within the flight training environment. According to Lintern (1995), flight instructors should remember that, in order for students to gain skill across a wide range of situations, they should ensure that their instruction involves many contexts supportive of typical flying situations. In doing this, flight instructors, through appropriate modeling, can facilitate the development of aviators, regardless of the aircraft that they fly.

Observational Learning

Observational learning requires four primary components, including attention processes, retention processes, motor reproduction processes, and motivation processes (Bandura & Jeffery, 1973). Although the FAA (2008) suggests that learning to fly is inherently motivating since flight students are not compelled to participate, Marshburn and Rollin (2005) found that Army aviators-in-training were specifically motivated to fly through primarily intrinsic processes such as a desire for competence, challenge, and mastery. Within observational learning, however, motivation is only part of the process.

Although it would appear that flight students are motivated to learn to fly, there are other processes operating within the interaction between the flight student and the flight instructor. Since learners have the capacity to only pay attention to a relatively few things at once (Schunk, 2012), the flight instructor must incrementally introduce concepts and maneuvers at a pace that ensures the student can practice and perform them (USAACE, 2015). Since learners must remember things if they are to be influenced by those things (Wood & Bandura, 1989), it is also not surprising that the FAA (2008) suggests that flight instructors continually assess those concepts that the student learns and remembers. Remembering concepts, however, does not make an aircraft fly. Instead, the student pilot must actually demonstrate the flight control inputs and other flight-related behaviors, but since flight students generally cannot safely operate all flight controls at once (Dohme, 1995), flight instructors typically introduce one flight control at a time in order to avoid overwhelming the students with too much information (FAA, 2008).

Self-Efficacy

Although observational learning places the onus on the learner to attend to observed or modeled behavior, to remember the modeled behavior, and to ultimately replicate the behavior if they are motivated to do so, the competence of the model ensures that the behavior will be learned correctly and, if necessary, remediated. Since flight training is inherently risky and "the more costly and hazardous the possible mistakes [can be], the heavier must be the reliance on observational learning from competent exemplars" (Bandura, 1986, p. 20). In other words, the flight instructor must be competent and able to immediately recover the aircraft from students' incorrect and potentially dangerous application of flight controls in order to protect the student and the aircraft from harm (FAA, 2008). The instructor's belief in their ability, or self-efficacy as a competent pilot, therefore, is important.

According to Bandura (1977), self-efficacy is a person's belief in their ability to accomplish a task or to succeed in certain situations. Influenced by four primary sources including performance accomplishment, vicarious experience, verbal persuasion, and psychological states, a person's self-efficacy is greatly influenced by success or mastery experiences (Bandura, 1977). Expectedly, the more success a person experiences in a given task or situation, the higher their self-efficacy will be as related to those tasks or situations. New tasks or situations, however, may affect a person's self-efficacy, depending on how they appraise their ability to execute the task (Bandura, 1977). These cognitive appraisals, especially involving novel situations, are influenced by many contexts, including those that are social and situational in nature (Bandura, 1977).

In the case of changing the initial entry training helicopter after more than 20 years, a flight instructor may not have the same self-efficacy beliefs that he or she had with the non-modernized helicopter. Depending on the instructor's prior experience with aircraft automation or whether the instructor considers it stressful to learn to fly a new aircraft with completely different characteristics while also learning to deliver a different curriculum to students, the ways in which they cognitively appraise the changes to flight training may impact their self-efficacy (Bandura, 1977). It is with this notion that an understanding of the ways in which flight instructors view these changes, both to the aircraft and to the curriculum itself, will enhance an understanding of the problem of practice, and ultimately inform an actionable intervention.

Literature Review

The change of training aircraft, from the simple non-modernized TH-67 to the technically advanced Airbus UH-72A Lakota, is not, in and of itself, undermining to student outcomes or to an instructor’s belief in their ability. The significant change to the flight training curriculum (USAACE, 2015), the degree that RWFT embraces the change to the curriculum, the effectiveness of the training program designed to qualify the instructors to teach students in the new aircraft (USAACE, 2016), and the instructors' perceptions of aircraft automation, in general, and using automation within initial entry flight training, in particular, will likely influence these feelings and ultimately affect student flight training outcomes. Each of these issues will either enhance or detract from the instructors' self-efficacy based on their individual cognitive appraisal of the changes (Bandura, 1977). As such, a review of the literature involving the impacts of curriculum change and organizational factors on teacher self-efficacy, as well as literature involving aircraft automation, follows below.

Teacher Self-Efficacy and Curriculum Change

Situating Bandura's (1977) conceptualization of self-efficacy on the practice of teaching, Tobin, Muller and Turner (2006) suggested that teacher self-efficacy involves the teacher's conceptualization of whether or not he or she has the ability to help students learn. Fortunately, significant empirical research exists demonstrating teacher self-efficacy, especially involving its impact on educational outcomes for students (Tschannen-Moran, Hoy, & Hoy, 1998). Recently, for example, Holzberger, Philipp, and Kunter (2013) found that through cross-sectional correlations involving longitudinal data collected from more than 150 teachers and almost 3500 of their students, high teacher self-efficacy not only predicted instructional quality but also, albeit to a lesser degree, predicted the overall success of the teaching process. Stated another way, lower teacher self-efficacy has significant implications for student outcomes, especially in terms of student attitudes toward the importance of those concepts that they are learning (Tschannen-Moran et al., 1998). Additionally, the teacher attitudes about what they are teaching will also influence students (Wierenga, Kamsteeg, Simons & Veenswijk, 2015; Yeo, Bennett, McNichol & Merkley, 2015). Any issue that negatively affects a teacher's self-efficacy, therefore, is important to understand.

One such issue that may affect teacher self-efficacy is curriculum change. According to Cerit (2013), when teachers are required to change their knowledge due to changes in curriculum, they may experience a decline in their sense of teacher self-efficacy, especially if the changes significantly increase their workload. These declines in teacher self-efficacy, as Cerit (2013) determined when examining 255 classroom teachers in Turkey, will generally affect the ways in which teachers actually implement these changes, ultimately predicting whether curriculum change succeeds or fails. In other words, successful curriculum change is dependent on the teachers' willingness to implement the changes, and this willingness is often based on the teachers' conceptualization of their abilities and knowledge associated with the changes (Roehrig, Kruse & Kern, 2007). Similarly, the degree to which the teachers participate in the change process appears significant and, according to Wierenga and colleagues (2015), educational results are dependent on teachers.

The team of researchers led by Wierenga (2015) illustrated the importance of teacher perception on curriculum outcome through a mixed-method approach involving semi-structured interviews and survey data in order to study the effects of significant curriculum change in a Dutch vocational training school on 64 vocational training teachers. Specifically, they found that the less teachers felt as though their needs as educators were being met through the curriculum change process, the more likely the teachers were to believe that the changes were based on stakeholder perception about the school as opposed to the educational outcomes of the students (Wierenga et al., 2015). Conversely, when developed by expert practitioners and focused on student outcomes, a significantly changed curriculum will likely lead to positive results since those skills considered essential to the experts will likely remain integral within the curriculum (Carr, Celenza, & Lake, 2009; Peeraer, De Winter, Muijtjens, Remmen, Bossaert, & Scherpbier, 2009; Wesolek, 2009).

Based on these findings, it follows that Yeo and colleagues (2015) found, through their ethnographic study involving the perceptions of 31 faculty members experiencing both curriculum and organizational change, that if faculty members face change without their input, then they typically experience significant tension, especially if these changes occur incrementally over time. The change to flight training, based on the incremental introduction of the technically advanced UH-72A Lakota, subsequently, may also induce tension. Flying technically advanced aircraft is very different from flying non-modernized aircraft (Dahlstrom et al., 2006) and a change to the teaching environment and the workload, based on the aircraft itself, may therefore affect the teacher self-efficacy of flight instructors (Hoy & Woolfolk, 1993; Tschannen-Moran, Hoy & Hoy, 1998). Additionally, since the flight instructors had no input into the introduction of this aircraft and had no input into the curriculum that they would ultimately teach, it would not be altogether surprising if their sense of teacher self-efficacy decreased as a result of the changes.

Attitudes Associated With Aircraft Automation

The advent of advanced technology has enhanced efficiency, safety, and overall productivity (Rottger, Bali & Manzey, 2009). Within the aviation community, the increased use of technology has generated significant debate about pilots' over-reliance on these aviation technologies (Naidoo & Vermeulen, 2014). Although the erosion of manual flying skills are typically discussed as an adverse effect of too much automation, concerns about decreased situational awareness also dominate the discussion (Naidoo & Vermeulen, 2014; Parasuraman & Riley, 1997). Still, empirical research involving attitudes associated with aircraft automation, especially within the helicopter community, is lacking. Few studies discuss helicopters and, instead, information associated with aircraft automation is typically focused on airline pilots. The implications of these studies, however, are salient.

Interested in identifying common factors associated with pilots' attitudes about aircraft automation, Naidoo and Vermeulen (2014) developed the Automation Attitude Questionnaire for

Airline Pilots and, through their factor analysis involving data collected from more than 262 airline pilots, the researchers found that five primary factors associated with aircraft automation attitudes emerged. These factors included (1) a pilot's understanding of the automated system; (2) a pilot's training to fully operate the automated system; (3) a pilot's trust in the information provided by the automation; (4) a pilot's sense that their workload either increased or decreased based on the automation; and (5) a pilot's perception of how well the automation is designed from an ergonomic perspective (Naidoo & Vermeulen, 2014).

Among the attitudes associated with aircraft automation, training and trust have obvious implications for flight training. In fact, skepticism based on concerns about not only the training requirements associated with aircraft automation but also whether or not pilots would trust the information that automated systems provide has induced skepticism about the utility of using advanced aircraft in initial training (Dahlstrom et al., 2006; Mitchell, Vermeulen, & Naidoo, 2009). This skepticism, depending on an instructor's prior experience with automation, may actually elicit a negative cognitive appraisal about teaching students to fly in an automated aircraft, thereby undermining their self-efficacy.

This skepticism was evident when, just prior to the introduction of the UH-72A Lakota helicopter to the initial entry rotary wing training program, senior Army aviators and instructors alike cautioned that not only would the students suffer as a result of not learning maneuvers considered basic for pilots, but also that they would be placed at risk by the overwhelming nature of excessive technology in the cockpit while learning to fly (National Commission on the Future of the Army [NCFA], 2015). Negative attitudes associated with teaching initial entry pilots in a technically advanced aircraft are not, however, unique to Army aviators. Instead, this concern has spanned the aviation industry and multiple studies have focused on student outcomes for decades, although these studies typically involved training seasoned pilots to fly advanced aircraft (Mitchell, Vermeulen, & Naidoo, 2009; Naidoo, Schapp, & Vermeulen, 2014; Naidoo & Vermeulen, 2014).

Among the research focused on advanced aircraft training, one study demonstrated that initial entry flight training using technically advanced aircraft was not only possible, but also successful for instructors and students alike (Dahlstrom et al., 2006). Despite its small sample of only 17 flight instructors and 12 flight students and while it involved airplanes only, the research suggested that as long as the flight instructors' training focused on how to actually teach basic flight skills in an advanced aircraft to the initial flight training students, then the students would reap the benefits of understanding the information provided by the automation as well as developing the ability to fly without it (Dahlstrom et al., 2006).

Organizational Factors and Their Impact on Teacher Self-Efficacy

Through Dahlstrom and colleagues' (2006) findings that demonstrated success involving initial flight training using advanced aircraft, it would seem that there would be little resistance to such a change in the Army's flight training program. From an organizational perspective, it is not uncommon for the implementation of technologies to be resisted. For example, even if the technologies will create positive outcomes in the long run, Leonardi (2009) found, while spending more than 500 hours observing 64 performance engineers who were given a new technology to develop crashworthiness models, that social interactions create the context in which members determine whether newly introduced technologies fit within the organizational culture. Organizational members may conclude that the specific technology is poor and resist using it, ultimately negatively affecting planned organizational change efforts (Leonardi, 2009). In the case of rotary wing flight training, instructor pilots may have already had the interpretation that automation would not be good for initial training (NCFA, 2015). Within the educational environment, change creates tension and when teachers are required to work in new settings and implement new curricula, they will likely experience changes to their teacher self-efficacy, for good or bad (Tschannen-Moran, Hoy, & Hoy, 1998).

Whether teachers adapt to change in educational settings, however, is often a function of the organizational leader (Hoy & Woolfolk, 1993). In other words, leader behaviors shape the organizational climate and can ensure that the organization is poised to meet changing environmental demands, whether through the implementation of new technologies or new curriculum (Davis & Daley, 2008; Hoy & Woolfolk, 1993; Oreg & Berson, 2011). The extent to which organizational members embrace opportunities to change appears significantly related to the organizational leader, and the more the leader encourages learning and open communication, the more likely members will embrace these opportunities (Kontoghioghes, Awbrey, & Feurig, 2005). Perhaps more importantly, when faced with significant organizational change, Oreg and Berson (2011) found, through correlational analysis of data collected from more than 580 teachers and 75 principals from 120 different schools in Israel, that the leader's disposition to change, transformational style, and personal values influenced the organizational members the most. If an organization's culture differs significantly from the change strategies such that the strategies actually violate cultural norms, however, then the implementation of any change strategy faces complication, regardless of leader behavior (Kezar & Eckel, 2002).

The degree to which an organizational leader ensures that the organization is poised to meet changing environmental demands and to adapt in ways that will ensure continued organizational growth, development, and employee success is associated with the concept of a *learning organization* (Davis & Daley, 2008; Garvin, Edmondson, & Gino, 2008;

Kontoghiorghes, Awbrey, & Feurig, 2005). According to Davis and Daley (2008), learning organizations employ multiple strategies, including providing opportunities to learn, providing leadership and vision about the importance of learning, and ensuring that the organization remains connected to its environment. These strategies will often enhance an organization's performance, but it is important to first focus on the creating the structural and cultural aspects of a learning organization (Kontoghiorghes, et al., 2005).

In the case of the changes to the flight training curriculum and training aircraft, the importance that the flight training organization places on learning this new aircraft, the manner in which the organization embraces these changes to the curriculum, and the communication to the instructors about the importance of these changes will likely shape their attitudes and self-efficacy about teaching students to fly using it (Kontoghiorghes et al., 2005; Hoy & Woolfolk, 1993). Especially valuable in this process is communication, as demonstrated by Taylor and Tashakkori (1995) who found through analyzing a sample of more than 9,000 teachers using multivariate regression analyses, that teachers' sense of efficacy is affected by aspects of organizational climate, especially an absence of obstacles to teaching (e.g., duties interfering with teaching) and effective communication among the faculty (e.g., coordination with other teachers and familiarity among teachers about the content taught).

Just as communication is an important process within learning organizations, improvements to curricula and to teaching technique require a supportive organizational environment (Tobin et al., 2006). Through research involving 679 teachers, Tobin and colleagues (2006) found that organizational learning and organizational culture involving participating in learning contributed significantly to teacher self-efficacy. In addition to enhancing self-efficacy, Davis and Daley (2008) suggest that managerial efforts aimed at developing knowledge will enhance an organization's likelihood of success by increasing its competitive advantage. In other words, the more an organization embraces the opportunity to learn and to connect to its changing environment, the more likely it will successfully adapt to change (Davis & Daley, 2008). In the case of the flight training organization, the significant change associated with the introduction of a new training helicopter and a new curriculum requires adaptation to a changing environment.

Summary of Factors Contributing to the Problem

Flight training is based on a social interaction between the flight instructor and the flight student (FAA, 2008). Although there is no empirical research involving the impact of using automated aircraft in initial helicopter pilot training, Bandura's (1986) social cognitive theory provides a useful theoretical framework for understanding the problem of practice associated with the changing flight training curriculum based on the introduction of the technically advanced UH-72A Lakota helicopter. In particular, through observational learning, flight students gain exposure to a flight instructor's modeled behavior of how to manipulate the flight controls and to operate the aircraft systems. The flight instructor's belief in their ability, or teacher self-efficacy, may affect the degree to which they effectively model this behavior. It is therefore important to understand factors that may undermine the flight instructors' teacher self-efficacy. Factors including the way in which curriculum change occurs, attitudes toward aircraft automation, and organizational factors associated with culture, learning, and leadership may either enhance or detract from a flight instructor's teacher self-efficacy. Through gaining a deeper understanding of how these factors affect the flight instructors themselves, it was possible to develop an actionable intervention that would positively affect the flight students they teach.

CHAPTER 2 - NEEDS ASSESSMENT

Chapter Overview

According to Dohme (1991), military rotary wing flight training must be both effective and efficient, by providing students with the essential skills necessary to fly and survive while operating in peace and in war, and simultaneously ensuring the least amount of cost in terms of resources and time. Implicit in these requirements, the rotary wing flight training community must routinely analyze the flight training program in order to identify necessary changes that will create the outcomes while improving its overall efficiency (Dohme, 1991).

Based on the previous chapter's notion that an actionable intervention that will positively affect flight students may be informed through an understanding of how the new aircraft affected the flight instructors, this chapter describes results of a needs assessment conducted in order to elicit the instructors' perceptions of this new training aircraft. Specifically, this chapter describes and presents results from the needs assessment focused on RWFT's UH-72 flight instructors who were providing initial entry rotary wing flight training to initial entry flight students.

Context of the Needs Assessment

Although RWFT provides classroom academic instruction as well as aircraft flight instruction in three separate aircraft types from four separate locations (e.g., an academic complex, an airfield, a heliport, and a simulator complex) within a flight training area of more than 40,000 miles, only those employees qualified to teach IERW in the UH-72 Lakota were the focus of this needs assessment (see Figure 2).

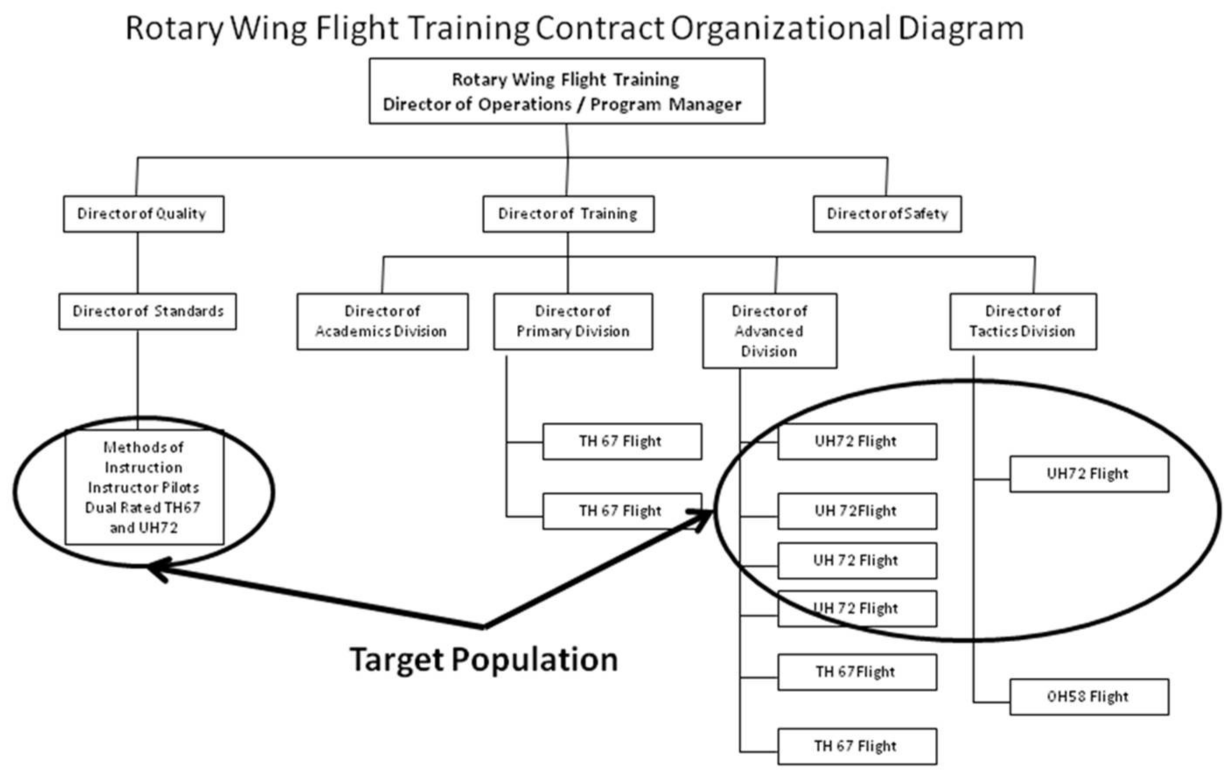

Figure 2. RWFT Organizational Structure

Goals and Objectives

The purpose of the needs assessment was to identify the ways in which the introduction of the technically advanced training helicopter affected the flight instructors as they began teaching future military aviators to fly using this advanced helicopter. Specifically, through systematically studying the flight instructors' perceptions and attitudes about the recently changed flight training curriculum involving the technically advanced aircraft in initial entry flight training, their perceptions of the training designed to prepare them to teach this new curriculum, and their perceptions about the ways in which RWFT adapted in order to support these changes, the following needs assessment would provide information about needs, gaps, and issues within not only RWFT, but also the rotary wing flight training community that RWFT serves. Since flight instructors would continue providing flight instruction during the incremental conversion to the advanced training helicopter, they would be, perhaps, best suited to identify issues with the syllabus and changes, if required, that would positively impact the students' ability to gain the skills essential for future aviators.

It is with this in mind that this needs assessment specifically sought to meet the goals of determining the training needs and the organizational needs of the flight instructors who teach flight students in the new helicopter. Specifically, the needs assessment sought to collect data associated with the following research questions:

(1) How do the UH-72A qualified instructors evaluate their teacher self-efficacy in teaching students to fly using the UH-72A?

(2) What are the UH-72A qualified instructors' attitudes toward aircraft automation?

(3) To what degree do the UH-72A qualified instructors perceive the effectiveness of their UH-72A aircraft qualification and instructor pilot transition training?

(4) To what degree do the UH-72 qualified instructors perceive RWFT to be operating as a learning organization?

The data collected to answer these research questions were envisioned to provide an impetus for change, if required, within RWFT and within the flight training program, for the benefit of the students and instructors alike. Just as Wierenga and colleagues (2015) found that positive curriculum change typically occurs if the teachers assist in the change process, the flight instructors themselves remain integral to the change process. Perhaps more importantly, according to Tschannen-Moran, Hoy, and Hoy (1998), teachers who have greater efficacy beliefs will more readily implement curriculum change. With this in mind, it is apparent that the flight instructors will remain integral to the success of the changing IERW curriculum, and will ultimately impact the education and training outcomes of the students they teach.

Methodology

The Johns Hopkins University's Homewood Institutional Review Board (HIRB) provided the approval to conduct this research in conjunction with the Research Methods and Systematic Inquiry I Course (ED.883.718.1D).

Participants

Data were collected during April 2017 from a sample of 57 RWFT employees who had earned designation as a flight instructor for the UH-72A aircraft. The entire population (*N* = 108) of RWFT's UH-72A flight instructors, at the time of data collection, was eligible participate in the study. The final sample consisted of 57 participants (100% male). Among the participants, 43 (75%) were Instructor Pilots, 9 (16%) were Methods of Instruction Standardization Instructor Pilots (MOI), and 5 (9%) were Managers, either serving as a flight commander or as an assistant flight commander. The mean time teaching within the initial entry rotary wing course at the site was 13.9 years (*SD* = 9.6, range 0.50 - 39). The mean time working as an employee on the rotary wing flight training contract was 13.4 years (*SD* = 9.6, range 0.50 - 34.25).

Of the 57 participants, 31 (54.4%) had flown less than 250 flight hours in the UH-72A, 18 (31.6%) had flown between 250 and 500 flight hours in the UH-72A, and 8 (14.0%) participants had flown more than 500 hours in the UH-72A. As an instructor pilot in non-modernized aircraft such as the TH-67, 51 participants (89.5%) had flown more than 1000 flight hours while 6 (10.5%) had flown less than 1000 hours as an instructor. As an instructor pilot in modernized aircraft, however, 36 (63.2%) had flown less than 1000 hours while 21 (36.8%) had flown more than 1000 hours. Finally, 23 (40.4%) of the participants had previously worked in the Contact Division, 22 (38.6%) had previously worked in the Instrument Division, 9 (15.8%) were newly hired and had never worked on the contract, and 3 (5.3%) had previously worked in the Tactics Division.

Measures

In order to more fully understand the perceptions of the flight instructors, the author who serves as the organizational leader of the Company (Director of Operations and Program Manager, see Figure 2), created an instrument (seven demographic multiple choice or fill-in-the-blank items, 50 likert-scale items, and a free response portion where respondents could add information if they felt the need to do so) designed to elicit responses involving demographic information, teacher self-efficacy, and perceptions about advanced aircraft training, automation, and learning organization functioning. Each of these content areas of the instrument is discussed below.

Demographic information. Part I of instrument required that the participant indicate, through a multiple choice format, the following: total flight time in the UH-72A (<250 hours = 0; 250 – 500 hours = 1; > 500 hours = 2); total instructor pilot hours in non-modernized aircraft (< 1000 hours = 0; >1000 hours = 1); total instructor pilot hours in advanced aircraft (< 1000 hours = 0; > 1000 hours = 1); the total time spent teaching within the Initial Entry Rotary Wing (IERW) course (in years and months); the training Division of IERW the participant taught in prior to their designation as UH-72 instructor, if applicable (Contact Division = 0; Instrument Division = 1; Tactics Division = 2; Air Force Division = 3; Academics Division = 4; Not Applicable = 5); their employment status (instructor pilot = 0; Methods of Instruction Standardization Instructor Pilot = 1; manager such as flight commander or assistant flight commander = 2); and the total time serving as an employee within the training organization (in years and months). Considerations of age, gender, and ethnicity were disregarded since the target population is a generally homogenous group.

Teacher self-efficacy. Within Part II of the instrument, 9 items were designed to elicit the participant's confidence in their ability to provide instruction in a way that will be learned appropriately by students, regardless of the students' ability or lack thereof. Adapted from Hoy and Woolfolk's (1993) Teacher Sense of Efficacy Scale (Short Form) and Bandura's Teacher Self-Efficacy Scale (as cited in Tschannen-Moran, Hoy, & Hoy, 1998), the questions required the participants, through a five-point Likert scale (1= Strongly Disagree, 3 = Neutral, 5 = Strongly Agree unless reverse score where 1 = Strongly Agree and 5 = Strongly Disagree), to indicate their level of agreement with statements oriented on ideas such as their ability to teach effectively with the resources they are provided, their ability to influence curriculum decisions, and their ability to teach difficult students. The items are scored on two subscales: personal teaching efficacy and general teaching efficacy.

Personal Teaching Efficacy is considered a more personalized measure of a teacher's self-efficacy and reflects their belief that they are sufficiently trained and experienced to help students learn, no matter the obstacles that may confront them (Tschannen-Moran, et al., 1998). *General Teaching Efficacy*, on the other hand, measures a teacher's beliefs about their teaching influence as affected by external factors such as the curriculum, resources, school community, and a student's environment (Tschannen-Moran, et al., 1998). Internal consistency for the items was acceptable for the 9 overall items (Cronbach's $\alpha = .70$) and the personal teaching efficacy subscale (Cronbach's $\alpha = .73$) while the general teaching efficacy subscale was considered marginal (Cronbach's $\alpha = .62$).

Learning organization. Part II of the instrument contained 22 items designed to determine the degree to which the participants agree with statements about the flight training organization's functioning as a learning organization. The items, rated on a five-point Likert scale (e.g., 1= Strongly Disagree, 3 = Neutral, 5 = Strongly Agree unless reverse scored where 1 = Strongly Agree and 5 = Strongly Disagree), required the participants to indicate their level of agreement with statements involving aspects such as the importance of education to the organization, openness to new ideas, organizational communication, and adaptation to change. Defined as an organization committed to continuous learning in order to improve and to meet the demands of the environment (Davis & Daley, 2008), the questions were adapted from Garvin, Edmondson, and Gino's (2008) 30-item Learning Organization Survey and Kontoghiorghes, Awbrey, and Fuerig's (2005) 108 item questionnaire. The items were scored on three primary scales: concrete learning processes and practices, supportive learning environment, and leadership that reinforces learning.

Concrete Learning Processes and Practices refers to a respondent's belief that the organization engages in information collection from stakeholders, analyzes its findings, ensures that employee are able to participate in training activities, and shares information and collaborates with experts internally and externally (Garvin, et al., 2008). *Supportive Learning Environment* refers to the respondent's belief that the organization is open to new ideas about what works and what doesn't, encourages reflection, and does not restrict innovation (Garvin et al., 2008; Kontoghiorghes, et al., 2005). Finally, *Leadership that Reinforces Learning* refers to the respondent's belief that their manager or supervisor encourages them to continually learn, seeks multiple points of view and invites input, and maintains open lines of communication with them about opportunities to learn (Garvin et al., 2008; Kontoghiorghes, et al., 2005). Internal consistency for the items was determined to be satisfactory for each subscale: concrete learning processes and practices subscale (Cronbach's α = .83); supportive learning environment subscale (Cronbach's α = .76); and leadership that reinforces learning (Cronbach's α = .78).

Attitudes toward aircraft automation. Part II of the instrument contained 8 items designed to elicit the participants' attitude about aircraft automation in general and automation within initial flight training in particular. Defined as the pilot's conception and opinion about the automation systems found on the aircraft they fly, these conceptions and opinions include human factors considerations, ergonomic configurations, and skepticism about the automation itself (Naidoo & Vermeulen, 2014). Adapting questions from Naidoo and Vermeulen's (2014) Automation Attitude Questionnaire for Airline Pilots, the eight questions required the participants to indicate, on a five-point Likert scale (e.g., 1= Strongly Disagree, 3 = Neutral, 5 = Strongly Agree unless reverse scored where 1 = Strongly Agree and 5 = Strongly Disagree), their level of agreement with statements about whether automation places them at risk, whether their flying skills decay as a result of automation, and whether automation affects their cockpit workload.

Although Naidoo and Vermeulen's (2014) 32 item survey instrument loaded on five factors (e.g., understanding, training, trust, workload, and design), the 8 items adapted and developed for this needs assessment were not selected in order to load on any particular scale. Instead, the items addressed particular aspects of automation that have historically emerged as important within the literature. For example, concerns about inadequate training to fly using automation, a potential loss of skill, and about the information provided by the automation often has induced skepticism about the utility of using advanced aircraft in initial training (Dahlstrom et al., 2006; Mitchell, Vermeulen, & Naidoo, 2009). Accordingly, the eight items were designed to be evaluated individually.

Attitude toward advanced aircraft training. Prior to teaching IERW students in the new helicopter, RWFT's flight instructors must attend the UH-72A Aircraft Qualification Instructor Pilot Transition (AQIPT) course, an eight week training program that provides 34 aircraft flight hours and 18 flight simulator hours, in order to gain the basic technical flying skills required to safely operate the aircraft (USAACE, 2016). Part II of the survey instrument contained seven items designed to elicit the participants' attitude about the effectiveness of this training. Focused on the perceptions of RWFT flight instructors who had completed the UH-72A AQIPT course in preparation for teaching IERW students, the items were adapted from Naidoo, Schapp & Vermeulen's (2014) Advanced Aircraft Training Climate Questionnaire (AATC-Q). The questions required the participants to indicate, on a five-point Likert scale (e.g., 1= Strongly Disagree, 3 = Neutral, 5 = Strongly Agree unless reverse scored where 1 = Strongly Agree and 5 = Strongly Disagree), their level of agreement with statements about the training program's organization, its difficulty, and its effectiveness. While Naidoo and colleagues' (2014) instrument included 33 items that loaded on three factors (e.g., organizational professionalism, intrinsic motivation, and individual control of training outcomes), the items included in this needs assessment were selected for the content of the question themselves, without concern about loading on a particular scale. As a result, each of the seven items was designed to be evaluated individually.

Attitude toward the IERW curriculum. Part II of the survey instrument contained one item designed to elicit respondents' perception of the newly developed UH-72A IERW curriculum. Specifically, the question required the participants to indicate, on a five-point Likert scale (e.g., 1= Strongly Disagree, 3 = Neutral, 5 = Strongly Agree), their level of agreement with the following statement: The IERW curriculum for the UH-72 needs revision.

Free response. Following the 50 items found within Part II of the survey instrument, the researcher provided the opportunity for respondents to offer information that they felt necessary to add. Specifically, the free response prompt (If there is anything you'd like to add, then please write in the space below) was added to the instrument in order to solicit qualitative data. Although there was no expectation that respondents would contribute, the researcher included the option in the event that some of the respondents felt compelled to do so.

Data Collection Methods

Participant recruiting and data collection. In order to coordinate the recruiting of participants and the collection of data for this needs assessment, the author solicited assistance from the organization's Division Directors who directly lead UH-72A qualified employees. Specifically, these Division Directors were provided participant packets based on the actual number of UH-72A qualified employees within their Division. Over the course of a two week period, these Directors announced the opportunity to participate during the instructor pilot shift briefs (the period of time prior to the instructors meeting their students in the classroom at the airfield). Of the 108 surveys prepared and distributed to the Division Directors in order to solicit participants, 66 were returned (return rate of 61%). Not all of the surveys, however, were usable. Specifically, nine were unusable due to sections being incomplete, such as the demographic portion (n = 3) or the second page being left blank (n = 6). As a result, the final sample consisted of 57 respondents (n = 57).

Research design. This needs assessment focused on identifying RWFT UH-72A flight instructors' perceptions about their teacher self-efficacy, about whether they believed that RWFT functioned as a learning organization, and about their perceptions of aircraft automation, in general, and aircraft automation within IERW, in particular. As such, this needs assessment was focused on exploring a population by gathering primary data through the employment of a survey instrument. Since the survey instrument provided the opportunity for respondents to qualitative information, however, this needs assessment followed the quantitative perspective with an acceptance of qualitative data in order to provide additional insight (O'Leary, 2014).

Statistical analysis. Data were analyzed in three phases. First, descriptive data for the sample were generated. Next, scores for the teacher self-efficacy scales and the learning organization scales were calculated while also determining the internal consistency of the scales through calculating Cronbach's α for each, as described in the measures section above. Finally, since data were collected on instructor pilots, methods of instruction standardization instructor pilots, and managers, a one-way ANOVA for each of the scales and each of the questions evaluated individually was performed to test whether the groups (instructor pilot, methods of instruction standardization instructor pilot, or manager) differed statistically. Since no prior data existed distinguishing these groups, the hypotheses tested suggested that there were no differences between the groups. Pending an initial finding of statistical significance, post hoc analysis involving the Bonferroni correction would have also been conducted.

Initial Summary of Results

Prior to generating any descriptive statistics or conducting any hypothesis testing, each participant's packet was scored and verified for completion. The scores for each of the items, both demographic questions from Part I and survey items from Part II, were entered into a database using Microsoft Excel and then imported into SPSS for analysis. Descriptive and inferential statistics were then calculated in order to derive implications from this needs assessment. Results of the preliminary data analysis and its implications, the results of statistical analysis and hypothesis testing, and some key findings are presented below.

Preliminary Data Analysis

The stated goals of this needs assessment involved determining the training needs and the organizational needs of the flight instructors who teach flight students in the UH-72A Lakota helicopter. Through addressing the research questions involving their teacher self-efficacy, the ways in which they viewed RWFT, their perceptions about aircraft automation, and their attitudes about their UH-72A training, an enhanced level of awareness regarding the impacts of introducing a technically advanced aircraft into initial helicopter training would emerge.

Teacher Self-Efficacy. The first research question related to the goals and objectives of this needs assessment involved identifying how the UH-72A qualified instructors evaluated their teacher self-efficacy in teaching students to fly using the UH-72A. As Table 1 demonstrates, the participants generally indicated a positive level of self efficacy, although it appeared that their individual sense of their personal teaching efficacy was stronger than their general teaching efficacy.

Table 1. *Teacher Self-Efficacy Scale Scores*

TEACHER SELF-EFFICACY	**Total Sample (*n* = 57)** ***M***	**Total Sample (*n* = 57)** ***SD***
Teacher Self Efficacy (Overall)	3.39	0.49
Personal Teaching Efficacy Subscale	3.61	0.61
General Teaching Efficacy Subscale	3.21	0.61

Learning Organization. The extent to which the participants believe that RWFT functioned as a learning organization is shown in Table 2. Upon first glance, it appeared that the participants exhibited general disagreement that the organization engaged in concrete learning processes and practices, suggesting that they generally disagreed that the organization actively engaged its external environment in order to engage stakeholders and to ensure that employees were able to participate in valuable training activities. Despite this concern, the participants indicated that they generally agreed that the organization provided a supportive learning environment and that they strongly agreed that their direct supervisor encouraged them to continually learn and maintained open lines of communication with them.

Table 2. *Learning Organization Scale Scores*

LEARNING ORGANIZATION	**Total Sample (*n*=57) *M***	**Total Sample (*n*=57) *SD***
Learning Organization (Overall)	3.18	0.48
Concrete Learning Practices and Processes Subscale	2.86	0.63
Supportive Learning Environment Subscale	3.24	0.33
Leadership the Reinforces Learning Subscale	3.71	0.63

Attitudes about aircraft automation. The general attitudes associated with aircraft automation were largely positive, as shown in Table 3. Specifically, it appeared that the participants generally disagreed that they were more exposed to risk, that they were more of a "button pusher," and that they would lose their manual flying skills. Although the participants generally agreed that they had much more "heads down" time in the UH-72 cockpit, they did not appear to indicate that their teaching was impacted, indicating a generally neutral feeling about feeling more stress in teaching students in the UH-72.

Table 3. *Attitudes about Aircraft Automation*

AUTOMATION QUESTION	**Total Sample (*n*=57) *M***	**Total Sample (*n*=57) *SD***
8. As an instructor pilot in the UH-72, I feel exposed to risk by the automation	2.56	1.09
10. I feel more a "button pusher" than a pilot	2.91	1.07
11. I am concerned about losing my flying skills with so much automation	2.72	1.10
14. Teaching in the UH-72 is more stressful than teaching in the older aircraft	3.11	1.13
15. There is much more "heads down" time in the UH-72 cockpit	4.16	0.77
21. Automation does not reduce total workload since there is more to monitor	2.83	1.23
23. I often question the output of the automation system in the aircraft	2.60	0.88
24. In the UH-72, I feel detached from the aircraft	2.44	0.89

Attitudes about advanced aircraft training. The participants' attitudes about their training in the UH-72A, however, were generally negative as shown in Table 4. Of particular note, the highest level of disagreement involved the perception that that UH-72A AQIPT course was well organized. Additionally, the participants generally disagreed that they were given sufficient time to prepare for the course and that the course was as good as previous courses that they had attended. Finally, the participants expressed fairly strong agreement that the AQIPT was extremely difficult and, not altogether surprising based on the difficulty of the course, that it was important to them to gain a deeper understanding of the aircraft.

Table 4. *Attitudes about Advanced Aircraft Training*

AIRCRAFT TRAINING	**Total Sample (*n*=57) *M***	**Total Sample (*n*=57) *SD***
9. I think that there should be more simulator training during the UH-72 Aircraft Qualification and Instructor Pilot Transition (AQIPT) course	2.74	1.16
17. The Aircraft Qualification and Instructor Pilot Transition (AQIPT) course is well organized	2.28	1.03
18. While participating in the Aircraft Qualification and Instructor Pilot Transition (AQIPT), I received sufficient feedback	3.18	1.00
19. I was given sufficient time to prepare for UH-72 training	2.91	1.14
20. It is important to gain a deeper understanding of the UH-72	3.93	0.65
22. My instructor qualification training in the UH-72 was extremely difficult	3.79	0.88
25. My training in the UH-72 was as good as any of my previous training.	2.56	1.18

Attitudes about the IERW curriculum. The participants' attitudes about the IERW curriculum strongly suggested that they felt as though the curriculum needed to be changed, as shown in Table 5. In fact, this particular question elicited the highest level of agreement throughout the sample.

Table 5. *Attitude about IERW Curriculum*

QUESTION ABOUT IERW CURRICULUM	**Total Sample (*n*=57) *M***	**Total Sample (*n*=57) *SD***
16. The IERW curriculum for the UH-72 needs revision	4.28	0.75

Statistical Analysis and Hypothesis Testing

Although the preliminary data analysis aggregated the entire sample, regardless of the participants' status as either an instructor pilot, as a methods of instruction standardization instructor pilot, or as a manager, an additional statistical analysis was performed in order to determine whether the groups differed in their perceptions. Subsequently, considering each scale for the self-efficacy and learning organization constructs, as well as each remaining item involving aircraft automation and aircraft training, as a separate variable of interest, the researcher performed a one-way ANOVA for each variable in order to determine whether the groups of UH-72A pilots differed in a statistically significant way.

Only one variable emerged as statistically significant within the groups (e.g., Question 17: The Aircraft Qualification and Instructor Pilot Transition (AQIPT) course is well organized). Results of the ANOVA suggested that the groups of UH-72A pilots differed with respect their perception that the UH-72A AQIPT course was well organized [$F(2, 54) = 4.038$, $p = 0.023$]. Post Hoc tests using the Bonferroni correction revealed that the mean score for the methods of instruction standardization instructor pilots ($M = 1.556$, $SD = 0.527$) was significantly different from the instructor pilots ($M = 2.489$, $SD = 1.077$) and from the managers ($M = 1.800$, $SD = 0.447$). The instructor pilots, however, did not significantly differ from the managers. Taken collectively, it appeared that the methods of instruction standardization pilots exhibited the highest levels of dissatisfaction about the course. This result was considered particularly important since these pilots are the instructors who are responsible for teaching the organization's newly hired instructors to fly the aircraft, although they must follow the AQIPT's course management plan developed by RWFT's military customer (USAACE, 2016).

Key Findings

In addition to finding that those instructors who were responsible for providing UH-72 qualification training to the organization's instructor pilots exhibited the highest level of dissatisfaction with the UH-72A AQIPT course (USAACE, 2016), there were two other topics that offered relatively important implications for this needs assessment. As the histograms in Figure 4 demonstrate, the two survey items with the highest levels of agreement and disagreement were oriented on the newly-implemented flight training curriculum for the UH-72A helicopter. The participants revealed their strong level of agreement that the IERW curriculum needed to change while also indicating that they believed that they had very little influence to change it.

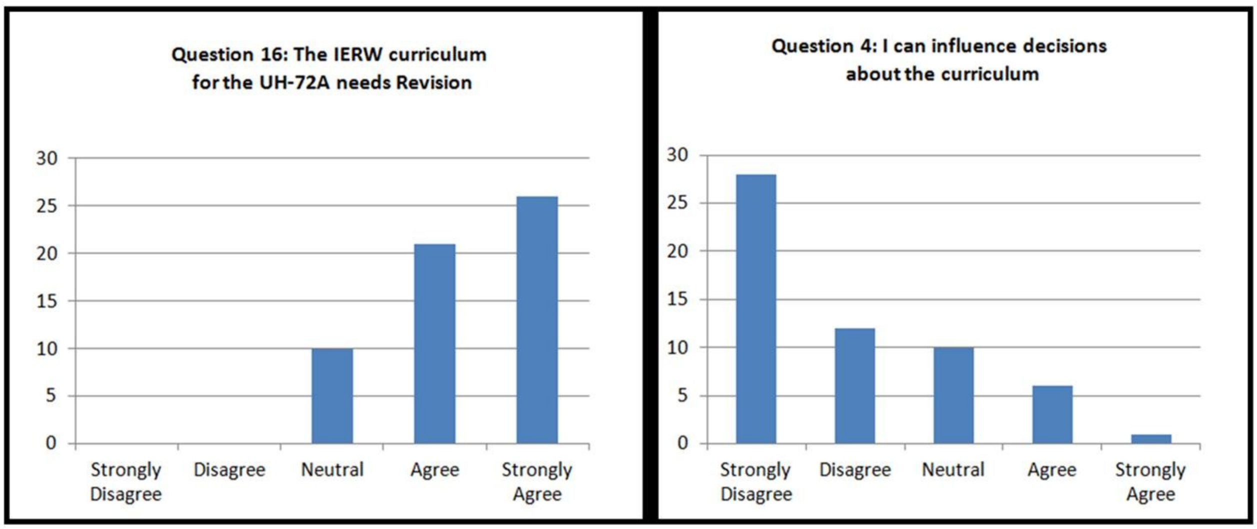

Figure 3, Histograms showing highest and lowest levels of Agreement

Qualitative Responses

Although not a significant portion of the data collection strategy, the author presented the participants an opportunity to provide additional information if they felt compelled to do so. Of the 57 study participants, 9 offered comments (see Table 6 below).

Table 6. *Needs Assessment Qualitative Responses*

Type of Respondent	Response
MOI	The AQIPT needs more hours for aircraft proficiency. The IERW course needs to treat the UH72 as a "training helicopter" and not the students' "helicopter for life."
IP	The UH72, while being a fantastic instrument flying machine, IS NOT A TRAINER!
IP	Part of the problem with questions related to UH-72 is the surprising lack of standardization given the military has had this aircraft since 2008!!! The amount of "I don't know" statements I hear in regards to how a system works, what we should do/know, etc. is appalling. The majority of contractors have great, doable ideas regarding safety, efficiency, and morale, yet are disregarded most of the time by [the military]… which is really sad.
IP	AQIPT was too rushed. Not enough description of how they wants students trained; plenty of what they want as an end product though.
IP	The UH72 Qual course does well at teaching you to fly/operate the aircraft. However, it did not give any insight on how to teach Primary flight training. I often wondered why a test class or two was not accomplished prior to spending so much money on these helicopters. Why did we not buy an American Aircraft?
IP	UH72 IPT [Instructor Pilot Training] is not, in any way, a replacement for legacy MOI [methods of instruction] training. Legacy advanced division IPs are poorly prepared to conduct BRWS [basic rotary wing skills] training and legacy primary IPs are not capable of safely and effectively conducting BI/ARWS [basic instruments/advanced rotary wing skills] training.
IP	The IQPT [AQIPT] course is not adequately constructed to prepare 72IP candidates for all phases of administering training for students. The only reason why it is currently "working" is because of the high quality of the IP candidates, and the training staff.
IP	Policies/rules/procedures are made too much at the higher staff levels without serious input at the lower level (IP) where "the rubber meets the road." Need a standards SOP. There are too many different techniques on how to do things.
IP	With new technology comes new challenges; what is supposed to make "life easier" often times makes it more complex. Remember basic is basic and advanced is advanced.

Upon review, it appeared that the qualitative information echoed the findings of the quantitative information. In other words, the comments suggested that the AQIPT course was in need of revision and that the instructors may have felt "unheard" about their concerns about being provided better training in how to teach using the new aircraft.

Conclusions

The results of the needs assessment suggested that there were gaps associated with the introduction of the technically advanced UH-72A Lakota in the initial entry rotary wing course.

The instructors who were teaching students to fly using the new technically advanced aircraft did not appear to have any negative opinions about the aircraft itself, but appeared averse to the actual curriculum they were required to teach. Likewise, the AQIPT course designed to provide them the skills to teach students in the new aircraft (USAACE, 2016) garnered negative attributions involving its organization, difficulty, and effectiveness. Although the instructors generally indicated positive levels of teacher self-efficacy, their previous self-efficacy as instructors in non-modernized aircraft was unknown, suggesting that, through the results of the questions oriented on the curriculum, it may have decreased. Their opinion about RWFT's functioning as a learning organization, likewise, seemed to suggest that they may feel somewhat constrained by RWFT as the concrete learning processes and practices, including providing adequate opportunities for training, elicited generalized disagreement.

Returning to the problem of practice that ultimately situated on whether the flight instructors' implementation of the newly developed curriculum enabled them to develop within their students both the manual flying skill expected of pilots (Airbus Helicopters, 2016; FAA, 2016) and the ability to function effectively with and without the aid of automation, it would appear that the instructors, if given the opportunity to influence the curriculum, would ensure that the needs of their students would remain proximal. Likewise, the AQIPT as an instructor qualification course appeared in need of review and revision and, based on the expertise of the methods of instruction standardization instructor pilots, it should be realistic to seek that opportunity. Moreover, by engaging stakeholder awareness about the findings of this needs assessment, the relatively weak feelings about the organization's use of concrete learning processes and practices may also be expected to improve.

CHAPTER 3 - INTERVENTION LITERATURE REVIEW

Chapter Overview

As previously discussed, the implementation of new technology leading to curriculum change is not novel in teaching organizations, and the extent to which teachers feel that they are part of the change process influences how they view the changed curriculum (Wierenga, Kamsteeg, Simons & Veenswijk, 2015). Depending on these views, teacher attitudes about the content of what they are teaching influence student outcomes, for better or worse (Wierenga et al., 2015; Yeo at al., 2015). More precisely, teacher willingness to implement curriculum change is largely based on their perception of ability and knowledge associated with the change (Roehrig at al., 2007) and, according to Cerit (2013), teachers often experience an initial reduction in these perceptions when they are required to change their knowledge.

The recent introduction of a technically advanced training helicopter in the initial entry flight training course necessitated one such change in teacher knowledge (HQDA, 2015). As reflected in the previous chapter, the new aircraft impacted flight instructors in terms of instructional processes, attitudes, and behaviors. Results suggested that, regardless of previous flight experience, flight instructors generally felt that the AQIPT course was poorly sequenced, too rushed, and ineffective at preparing them to teach students in the new aircraft. Perhaps related to this general dissatisfaction about the course, the results also suggested that the flight instructors did not feel as though RWFT supported its employees by providing valuable training activities.

Despite the impacts resulting from the new aircraft, strategies to teach new pilots to fly have remained unchanged for decades (Lindo et al., 2012) even though flying a technically advanced aircraft is significantly different than flying a non-modernized aircraft and completely changes the workload in the cockpit (Dahlstrom et al., 2006). Specifically, pilots of advanced aircraft must be able to seamlessly transition between basic technical flying skills and non-technical aircraft automation management skills (International Federation of Airline Pilot Associations [IFALPA], 2012). Likewise, flight instructors teaching students to fly in a technically advanced aircraft must be able to not only employ these non-technical skills, but also teach them since focusing only on teaching students the manual flying skills will not create a professional pilot (IFALPA, 2012). Stated another way, the instructors must be able to teach their students both the technical and non-technical skills. Despite this requirement, the AQIPT is oriented only on the basic technical flying skills and lacks information on the non-technical automation management skills in general, and the teaching of these skills, in particular (USAACE, 2016).

The findings from the needs assessment illuminated not only a gap in non-technical automation management skill training, but also a negative perception about RWFT. Since the military retains ownership of the AQIPT (USAACE, 2016), it is unlikely that this training program could be directly changed in the short-term. Instead, only those issues within the control of RWFT itself may be changed. Subsequently, this chapter focuses on those organizational methods that could be enacted in order to reconcile the issues identified through the needs assessment research. The purpose of this chapter, therefore, is to discuss how an intervention may reconcile the gap in training while also contributing to organizational functioning. Prior to presenting a comprehensive synthesis of intervention literature, however, it is important to provide a theoretical framework that, according to Grant and Osanloo (2014), will serve to logically connect disparate topics within the literature review.

Theoretical Framework

In order to reconcile the AQIPT's ubiquitous lack of information on teaching non-technical skills (USAACE, 2016), an intervention should strive to provide flight instructors additional information about these skills in order to deepen their knowledge about teaching students to fly in the newly-introduced advanced aircraft. Since organizational perceptions also emerged as an important factor in the needs assessment, an intervention should also have an ability to influence the ways in which the flight instructors view the organization in which they work. Therefore, an appropriate intervention should enhance flight instructors' ability to teach students, and also should improve their perceptions about RWFT. With this in mind, organizational theory based on the work of von Bertalanffy's (2008/1950) systems theory provides a useful foundation.

Since von Bertalanffy (2008/1950) first developed the concept of systems theory, its tenets have emerged as relevant to organizations of all kinds. In its most basic sense, organizations are systems comprised of multiple inter-related parts that, together, amount to more than the parts alone. The interactions of these parts are dynamic and largely unpredictable, yet purposeful processes (Suter, Goldman, Martimianakis, Chatalalsignh, DeMatteo, & Reeves, 2013). In other words, within organizations, everything is related and within a system, if changes are made to one part, then changes in other parts can be expected (von Bertalanffy, 2008/1950). The same holds true for RWFT, and developing an intervention focused solely on flight instructors, for example, can be expected to impact the entire organization.

According to von Bertalanffy (2008/1950), the basic structural components of a system include *inputs* (e.g., resources provided by the external environment, including knowledge, skills, and abilities), *throughput processes* (e.g., the methods by which inputs are converted or transformed within the system), *outputs* (e.g., the results, products, or services created by the system that are returned to the external environment), and the *external environment* (e.g., those elements outside the system such as available resources, needs, and feedback that have the potential to affect the system). Feedback is especially important within a system since it provides a continual source of information about the actual throughput process itself, creating the impetus for change if warranted (Kast, & Rosenzweig, 1972).

With these concepts in mind, it follows that organizations are dependent on their environment to provide them the resources and the feedback that will ultimately sustain them, since the outputs essentially restart the system (Mele, Pels, & Polese, 2010). As organizational interventions often endeavor to increase employee competence in order to better contribute to organizational outcomes (Wang, Dou & Li., 2002), interventions can be expected to produce results, such as increased knowledge, skill, or ability, that then become an input to the system. Subsequently, through the use of a systems approach, the ways in which organizational interventions contribute to organizational outcomes can be derived, even for nonmonetary outcomes such as employee attitudes about the organization (Wang et al., 2002).

Within organizations, Wang and colleagues (2002) suggest that it is possible to consider an intervention as part of the Human Resource Development subsystem where the inputs include the resources required to develop the intervention (e.g., content-related materials, equipment, etc.), the throughput processes include the specific intervention itself (e.g., training program), and the outputs include the change in employee behavior targeted by the intervention (e.g., enhanced performance). The results of the intervention are then fed back to the organizational system where employees' newly-developed skills are considered inputs to the organizational system, put to use within the throughput process, and yield performance outcomes, including employee satisfaction, as output (Jackson & Schuler, 1995). This process is shown in Figure 4 below.

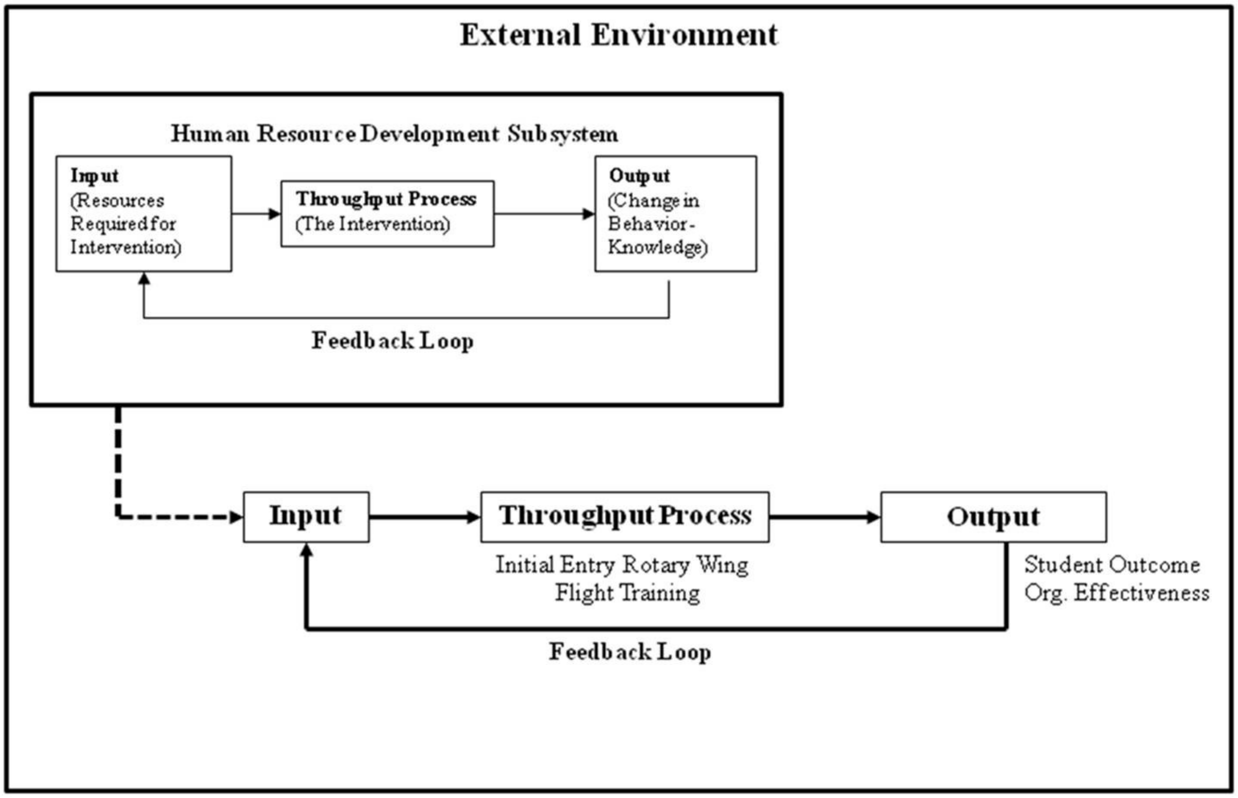

Figure 4. The Organizational System and its Human Resource Development Subsystem. Adapted from Wang et al., 2002

Based on this systems framework, and returning to the issues providing the impetus for an intervention (e.g., dissatisfaction with the AQIPT and negative perceptions about RWFT's willingness to provide valuable training opportunities), it was reasonable to conclude that since the external environment had not provided the non-technical automation management training in order to develop the knowledge within the instructors (the inputs), the flight instructors may not have been optimally poised to provide flight instruction in the new aircraft (the throughput), subsequently affecting their performance as teachers and also their job satisfaction as employees (the outputs). Therefore, the following literature review uses an organizational systems lens to synthesize intervention literature through addressing skill development at the individual level while simultaneously focusing on the ways in which this skill development may affect processes and outcomes at the organizational level.

Review of Intervention Literature

When considering methods to reconcile the gap in training created by the AQIPT, remarks by Ehrhardt, Miller, Freeman, and Hom (2011) are salient, suggesting that organizational training initiatives will not only help employees to meet their work-related requirements, but also may positively shape their attitudes about the organization. Since RWFT's UH-72 flight instructors expressed general dissatisfaction about their UH-72 training, it was reasonable to expect that their efficacy as teachers may have also decreased as a result of being required to teach students in an unfamiliar aircraft (Cerit, 2013). Likewise, since the flight instructors generally perceived that RWFT was reluctant to provide them valuable training opportunities, it was also reasonable to expect that the flight instructors' perception of how RWFT values their contributions may have decreased. An effective intervention, therefore, should create demonstrable outcomes, both at the individual flight instructor level and at the organizational level. Subsequently, the following literature review synthesizes empirical intervention research focused on the structural components of an organizational system.

Within this literature review, research focused on enhancing knowledge, skill, or ability (the input within the human resource development subsystem) through professional development (the throughput process within the subsystem) served as a useful launch point. For example, according to Wang and colleagues (2002), by reviewing professional development literature using a systems lens, it becomes possible to understand how professional development manifests itself in terms of employee behavior in implementing the new knowledge, skill, or ability (the throughput process in the organizational system). Finally, and perhaps most importantly, literature offering ways in which professional development may influence employee perception about the organization (the output) causing the employee to provide useful information back to the organization about his or her perceptions (the feedback) may illuminate concepts that work and those that don't. Through synthesizing literature focused on the structural components of an organizational system (von Bertalanffy, 2008/1950), and by identifying those aspects that are both relevant and actionable, the underpinnings of an effective intervention will emerge.

System Inputs (Knowledge, Skills and Abilities)

System inputs include resources such as time, funding, skills, knowledge, and abilities (Jackson & Schuler, 1995). Before flight instructors can apply their skills and abilities to teach students, including the non-technical automation management skills, they need to learn these skills. While there is very little research available on flight instructor training, in general, and improving flight instructor training, in particular (Crow, Niemczyk, Andrews, & Fitzgerald, 2011), professional development programs have a long history of assisting employees to develop additional skills and to gain increased competence in their job tasks (Steinert, 2010). Prior to understanding the ways in which these non-technical skills are developed, however, it is important to first understand the concept of non-technical skills in general.

Non-technical skills within the aviation industry. The importance of non-technical skills within the aviation industry is well-known since, overwhelmingly, accidents are not based on poor technical skill but instead are the result of failures in non-technical skill (Ruff-Stahl, Vogel, Dmoch, Krause, Strobl, Farsch, & Stehr, 2016). These skills are associated with enhanced pilot effectiveness and are typically conceptualized to be a part of the crew resource management (CRM) milieu, often involving interpersonal skills such as teamwork, decision-making, and communication (O'Connor, Campbell, Newton, Melton, Salas & Wilson, 2008). Within the Army, these skills have been associated with the Army's Aircrew Coordination Training (ACT) program, tailored after the demonstrated success of the civilian airlines' CRM model since the 1990s (Katz & Grubb, 2003). Though similar, however, crew resource management and aircrew coordination are not synonymous with non-technical aircraft automation management skills.

Although there is no standardized taxonomy of non-technical skills or programs to teach the skills, interest in identifying non-technical skills with the aviation industry has grown (Flin, Martin, Goeters, Hormann, Amalberti, Valot, & Nijhuis, 2003). Using the airlines' CRM programs as a launch point, Flin and colleagues (2003) developed the *NOTECHS* (non-technical skills) rating system in order to identify the ways in which pilots were effectively using the skills during pilot flight evaluations. As originally developed by Flin et al., (2003), these categories include cooperation (e.g., pilot monitoring, establishing open communication, and offering assistance during demanding situations), leadership and management skills (e.g., workload management through distribution of crew tasks and through allotment of sufficient time to complete tasks), situation awareness skills (e.g., automation monitoring by acknowledging and understanding aircraft systems changes), and decision-making skills (e.g., identification of problems and working with the crew in order to develop options to reconcile the problems).

Through the development of the NOTECHS instrument, pilot behaviors, other than those involving technical flying skills, could be evaluated (Flin et al., 2003). Unlike technical flying skills, the non-technical skills that were evaluated included those not directly observable such as the use of automation in order to aid in task accomplishment (Flin et al., 2003). In developing and validating this rating system, experienced pilots viewed videos of scenarios filmed within flight simulators in order to identify pilot behaviors that represented good practice as well as those that represented bad practice (Flin et al., 2003). Although the system was not created in order to teach the skills, of the 105 airline flight instructors evaluating the NOTECHS rating system, 88% of them were ultimately satisfied with it, especially if the terminology used in the video scenarios was typical within the contextual aspects of the pilots' operational environment (Flin et al., 2003). Therefore, non-technical skills are identifiable.

Demonstrating the usefulness of the NOTECHS taxonomy through a study involving observational design, Thomas (2004) evaluated the observations of 25 senior flight crew members in order to determine the relative importance of nontechnical skills to threat detection and error management as they relate to aviation operations. Through logistic regression techniques, the researcher noted that over the course of the 508 errors occurring during the 323 observed commercial airline flights, effective performance was a function of the relationship between a pilot's situational awareness and their understanding of aircraft systems status (Thomas, 2004). Additionally, albeit counter-intuitively, the non-technical skill of workload management was negatively related to threat detection and error management, suggesting that while task assignment is important, it can create a lack of situational awareness, reinforcing the need to remain vigilant in monitoring other crewmembers and other systems that may not be the focus of the specific workload tasks (Thomas, 2014).

Just as the NOTECHS instrument proved its value in evaluating non-technical skills of pilots during flight operations (Flin et al., 2003; Thomas, 2004), Ruff-Stahl and colleagues (2016) validated the NOTECHS instrument as a method for assisting airlines select pilots for initial training. Providing information about specific non-technical skills, the researchers adapted the NOTECHS instrument and created a modified score form that divided the instrument into a social and cognitive assessment (Ruff-Stahl et al., 2016). Though their pilot study for the validation consisted of only eight pilot training candidates, Ruff-Stahl et al., (2016) created an experimental condition where each of the novice participants conducted traffic patterns in a flight simulator, assisted by pilot instructors. By evaluating only the non-technical skills of the participants, the researchers determined that if the NOTECHS instrument is to be used in order to screen potential trainees, certain behavioral markers should be removed from it, such as conflict solving, providing and maintaining standards, awareness of time, risk assessment, and outcome review (Ruff-Stahl et al., 2016).

Non-technical skills beyond the aviation industry. Some argue that certain medical fields share characteristics with the aviation industry, including maintaining situational awareness and being able to effectively operate in ambiguous and stressful situations (Fletcher, McGeorge, Flin, Glavin, & Maran, 2002). Perhaps due to these similarities, coupled with the positive impact of crew resource management on aviation safety, as well the utility in evaluating the non-technical skills of pilots (Flin et al., 2003; Ruff-Stahl et al., 2016; Thomas, 2004), interest in extending non-technical skills information has extended beyond the aviation community (McCulloch, Mishra, Handa, Dale, Hirst & Catchpole, 2009; O'Connor et al., 2008). The medical education field, in particular, has embraced simulation-based, non-technical skills training as a typical curriculum focus to enhance safe practice (Gordon, Fell, Box, Farrell & Stewart, 2017). Further, citing the importance of non-technical skills in order to meet these workplace demands, the non-technical skills of monitoring, situation awareness, and teamwork have emerged as some of the most critical skills required (Fletcher et al., 2002).

According to Gordon, Darbyshire and Baker (2012), when reviewing more than 31 peer-reviewed articles, there was concordance across the studies in terms of the necessary non-technical skills (e.g., awareness, communication, systems and technology, and error analysis).

Likewise, through conducting meta-analysis, Hull and colleagues (2012) found that the nontechnical skill of situational awareness was associated with a reduction of technical errors and that overall performance and safety can be expected to increase following training designed to improve non-technical skills.

Skill development within educational organizations. As indicated above, non-technical skills such as monitoring, situational awareness, and workload management are critical to effective performance for practitioners in both the aviation and medical communities (Fletcher et al., 2002; Flin et al., 2003; Gordon et al., 2012; Ruff-Stahl et al., 2012; Thomas, 2004). When the practitioners must teach these non-technical skills to other practitioners-in-training, however, it is also important to ensure that these teachers are poised to inculcate within their students not only the non-technical skills knowledge, but also the behavioral ability to use them. Within educational organizations, professional development programs for teachers can increase content knowledge which can lead to increased teaching efficacy and, ultimately, an improved ability of teachers to help their students learn (Fritz, Miller-Heyl, Kreutzer, & MacPhee, 1995; Martin, McCaughtry, Hodges-Kulinna, & Cothran, 2008; Ross & Bruce, 2007; Watson, 2006). Professional development programs that focus solely on teacher behaviors, however, will affect student outcomes less than those programs focused on content knowledge and information about how students will learn the material, indicating that content emphasis should remain the focal point for teacher professional development programs (Wayne, Yoon, Zhu, Cronen, & Garet, 2008).

Recognizing the impact of efficacious teachers in the classroom as it relates to pedagogical expertise and student engagement, Swackhamer, Koellner, Basile, and Kimbrough (2009) explored whether teachers' efficacy could be increased by providing content-knowledge while also emphasizing pedagogy. Over the course of five years, the researchers conducted a mixed methods study involving a final sample of 88 inservice teachers in the Denver, Colorado area, concluding that by increasing the teachers' content knowledge and exposing them to effective teaching techniques, their efficacy increased (Swackhamer et al., 2009).

These findings showcase the importance of Pedagogical Content Knowledge (PCK), defined by Shulman (1986) as the combination of a teacher's content knowledge, pedagogical knowledge, and the context of the learning situation. According to Van Driel and Berry (2012), increasing PCK is a worthwhile goal of professional development programs. In fact, Invargson, Meiers, and Beavis (2005) offer that professional development programs will have a greater likelihood of improving student learning if the professional development program increases the teacher's content knowledge while providing strategies for ways in which to convey the material understandably to students. In other words, PCK extends beyond subject matter expertise and encompasses the tactics teachers use to make the information understandable to their students (Shulman, 1986).

System Throughput Processes (Creating the Outputs)

Throughput processes include the ways in which an organization utilizes the inputs, transforms them in some way, and ultimately exports outputs (Kast & Rosenzweig, 1972). Within the organization itself, these processes include employee behaviors (Jackson & Schuler, 1995), such as teaching students to fly. As noted by Wang et al., (2002), an organization's Human Resources Development subsystem exists, in part, to create a change in employee behavior or knowledge through an intervention (the throughput process), and if the intervention is successful, then this change of behavior or knowledge will be returned to the organization as an input benefiting the overall organizational system. In this case, the intervention involves changing flight instructors' knowledge of non-technical skills as well as their ability to teach these non-technical skills to their students. In order to increase the likelihood of success, it is necessary to identify the ways in which successful professional development programs for pilots and for teachers have been delivered. Stated another way, by understanding the ways in which non-technical skills have been developed in pilots and other professionals requiring these skills, and by understanding the ways in which successful professional development programs have been delivered to teachers, the throughput processes for interventions that may best accomplish the goals of the intervention involving UH-72 helicopter flight instructors will likely become clear.

Effective professional development practices. Professional development is most powerful if it meets the needs of the participants (Invargson, Meiers, & Beavis, 2005) and if they are able to apply the concepts to their work environment (Grohmann, Beller, & Kauffeld, 2014). Additionally, successful professional development programs typically involve at least 30 contact hours and, in general, outside experts play a key role in the delivery of these programs (Guskey & Yoon, 2009) provided that they are able to convey their knowledge about the material and the optimal ways of teaching it (Burke & Hutchins, 2008). According to Aguinis and Krager (2009), the most powerful professional development training programs include either cognitive or interpersonal skills. The researchers also suggested that if trainees are provided the opportunity to make errors while also being provided explicit instructions designed to help them learn from the errors, then the maximum benefit of the training will emerge (Aguinis & Krager, 2009).

Whether or not professional development training transfers to the workplace is associated with best practices involving the ways in which the intervention is implemented (Burke & Hutchins, 2008). Using survey data collected from 139 training professionals, results of quantitative content analysis suggested that interventions involving supervisor support, providing coaching, and offering the ability to practice the knowledge and skills within the workplace environment yield the best transfer of training (Burke & Hutchins, 2008). Adding to this by reporting the findings of a large-scale review of professional development literature, Guskey and Yoon (2009) offer that all successful professional development programs have involved workshops.

Professional development programs for non-technical skill development. Through their review of literature, Hull and colleagues (2012) perpetuated the idea that, while technical skills are supported by non-technical skills, most training programs focus on either technical or non-technical, at the expense of the other (Hull et al., 2012). In fact, there is no standard method or content associated with non-technical skills training, but multiple studies have shown positive effects of these programs (O'Connor et al., 2008). Based on these findings, it appears that a training program focused solely on developing non-technical aircraft automation management skills would also be effective. It is therefore not surprising that aviation safety experts suggest that, whether utilizing lectures, multimedia content, behavioral practice, or scenario-based training events, the non-technical skills should be taught even though there is no established protocol for teaching them ("Non-technical skills," 2016). There is, however, a common process for the effective development of non-technical skills based on teaching methods such as simulation, observation, feedback, and reflection (Gordon et al., 2012).

Based on the successes of simulation training within the aviation industry, Zausig and colleagues (2009) conducted an experiment in order to identify whether simulation training would affect the non-technical skills of relatively new anesthesiologists. Unlike other studies, the researchers randomly assigned 45 participants into either a non-technical skills training and medical management training group (the experimental group) or a group with only medical management training. Providing instruction on non-technical skills to the experimental group and using simulated crises in order to reinforce the non-technical skills knowledge, results of MANOVA demonstrated that the experimental group exhibited statistically significant differences in non-technical skills usage when facing crisis situations as compared to the control group. Subsequently, non-technical skills can be learned and reinforced over the course of a professional development program involving both lecture and hand-on practice through simulation (Zausig et al., 2009).

Training programs utilizing simulated environments hold promise for an ability to analyze the usage of non-technical skills and their contribution to technical performance (Hull et al., 2012). Noting that the use of simulation to provide non-technical skills training within medical education is relatively common, Garden, Le Fevre, Waddington, and Weller (2015) offer that a thorough debriefing facilitated by an expert practitioner is important. Specifically, they suggest that without effective facilitation by a debriefer, the learning outcomes may actually suffer (Garden et al., 2015).

Through a repeated measures protocol with a control group, 42 anesthesia residents received simulation-based training in order develop non-technical skills (Savoldelli, Naik, Park, Joo, Chow, & Hamstra, 2006). Groups receiving feedback on their performance (either oral feedback and videotape assisted oral feedback) showed statistically significant increases in their non-technical skill while the control group that received no feedback showed no increase (Savodelli et al., 2006). These results suggest that non-technical skills can be trained through scenario-based, simulated events and that non-technical skills can be increased through providing feedback to the participants about their use of the skills.

Interested in how a simulation-based intervention might influence the acquisition of non-technical skills in medical practitioners, Gordon and colleagues (2017) conducted qualitative research involving focus group interviews in order to understand how a non-technical skills intervention affected their practice. The intervention required interprofessional teams of six to nine participants, following non-technical skills training, to participate in three sessions of simulated medical activities, followed by immediate debriefing and a facilitated discussion surrounding the identification of errors associated with non-technical skills (Gordon, Fell, Box, Farrell, & Stewart, 2017). At the conclusion of the intervention, researchers solicited volunteers to participate in focus group interviews in order to further understand the participants' experience with the training, especially as it related to operating as an interprofessional team (Gordon et al., 2017). Although data were collected from only two focus groups of six participants each, the researchers found that simulation-based learning of non-technical skills delivered in a group setting has not only the potential to illustrate the teamwork aspect of non-technical skills, but also provides an opportunity to work through the anxiety that naturally occurs during crisis situations involving interprofessional groups (Gordon et al., 2017).

Professional development for pilots. Since the 1990s, aviation training programs have utilized multiple methods for providing training to pilots (Salas, Rhodenizer, & Bowers, 2000). When first beginning the process of crew resource management training, for example, role play techniques and simulated cockpit trainers were prevalent, but the lack of realism required a high level of imagination to simulate the cockpit environment (Baker, Prince, Shrestha, Oser & Salas, 1993). In fact, due to widely disparate training methods and citing a lack of agreement on the skills needed in the cockpit and how to teach those skills, Salas et al., (2000) offered that delivery methods such as lectures and scenario-based training have demonstrated effectiveness, especially when coupled with flight simulation. Further, they offer that by simulating the flight environment while showing trainees both positive and negative examples of cockpit behavior, the trainees were poised to better generalize the behaviors than trainees who only saw positive examples (Salas et al., 2000).

Illustrating the wide variety of training techniques, Baker et al., (1993) studied the effects of computer-based aviation games on 112 military aviators, only 22 of whom had previous exposure to crew resource management training. Through flying scenarios involving marginal weather and in-flight emergencies, data collected from the participants suggested that the use of computer games has the potential to be effective as a training tool and, based on the participants' reactions to the study, the researchers concluded that, as long as the scenarios were designed well, the use of computer games was an effective training modality to teach crew resource management (Baker et al., 1993). More recently, through implementing a one-factor between-groups design, twenty-four novice pilots participated in an experimental study designed to evaluate the effectiveness of a training program focused on enhancing situational awareness, a key non-technical skill (Bolstad, Endsley, Costello, & Howell, 2010). The intervention program involved (1) reviewing computer-based training modules focused on checklist adherence, air traffic control comprehension, and higher order thinking skills; and (2) conducting simulated flight scenarios using basic flight simulation software installed on a desktop computer (Bolstad et al., 2010). Through pre-test/posttest comparisons of means between the experimental and control groups, the researchers concluded that the there was only limited utility in using the modules to improve situational awareness (Bolstad et al., 2010). Although not overly compelling, the results of this study did provide evidence that training programs for pilots can be effectively deployed using desktop software and self-study training modules, potentially adding to the possible delivery methods of a professional development program.

Since commercial airlines and military aviation communities generally operate as crews, additional consideration is given to deploying training programs focused on team dynamics since individual skills such as leadership and communication can influence team behavior which will set the conditions for team performance (Salas et al., 2000). Theoretically, crew-centered flight training that is grounded in experiential learning using scenario-based flight simulation has the potential to positively impact individual pilot behavior which will affect crew performance while operating in a multi-crew environment (Thatcher, 2007). Regardless of the training's orientation on individual pilot or aircrew team, however, Salas and colleagues (2000) offer that as long as there is both information presentation and practice opportunities during the training, trainees will be able to perform the skills in any context.

Professional development for teachers. Just as interventions implemented within aviation organizations should positively impact pilot or crew performance (Salas et al., 2000), interventions implemented within teaching organizations should result in better ways to teach or to engage students or fellow teachers in the learning context (Guskey & Yoon, 2009). Although Guskey and Yoon (2009) offer that all successful professional development programs for teachers, in addition to being delivered in workshop format, are focused on increasing content knowledge and pedagogical skill, Steinert and colleagues (2008) remind practitioners that workshops are also worthwhile since they offer flexibility and opportunities for active learning. Collectively, these comments suggest that a successful professional development program for teachers should include a workshop component. Further, if professional development programs for teachers are developed with opportunities for active teaching, assessment, observation, and reflection, then there is a likelihood that the teachers will emerge from the program with enhanced abilities to teach students (Matherson & Windle, 2017).

Although successful professional development programs for teachers are conducted over a fairly significant time period, the programs must be carefully designed and focused on content knowledge and pedagogical skill (Guskey & Yoon, 2009). Whether professional development workshops include a self-study component, which can also increase a teacher's knowledge base (Goodnough, 2006), or include opportunities for group work involving problem solving, Guskey and Yoon (2009) suggest that successful professional development for teachers should be research-based, active learning experiences that can be adapted to teachers' classroom environment. It is therefore not surprising that teachers, as noted by Matherson and Windle (2017), want their professional development programs to be (1) engaging and relevant; (2) practical by showing better ways to deliver content; (3) teacher-driven so that they have a voice in the content of the professional development program; and (4) sustained over time.

As the systems perspective of the throughput process involves the transformation of inputs into outputs, activities that enhance the ways in which organizational members (e.g., teachers) participate in these processes, including engaging other members, will affect the organizational system by encouraging team learning and the development of shared mental models (Mele, Pels, & Polese, 2010). These team learning processes include the establishment of communities of practice (Wenger, McDermott, & Snyder, 2002) and developing learning organization processes, both of which can ensure that teachers continue learning from one another well after the professional development program ends. Subsequently, each is discussed separately below.

Team learning and the community of practice. Within teaching organizations, team learning can result in the development of a Community of Practice (CoP), defined as “groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis” (Wenger et al., 2002, p. 4). In addition to enhancing practitioner expertise and performance, CoPs have been linked to enhanced teaching practices (Bertram, Culver, & Gilbert, 2017) and organizational effectiveness (Baker & Beams, 2016), including the effectiveness of aviation training organizations.

Within Australia’s aviation training community, Bates and O'Brien (2013) established Mentoring Aviators Through Educational Support (MATES), a professional development CoP shared by flight instructors, and flight students alike, that was envisioned to not only provide a community offering peer engagement among the students, but also an opportunity to develop practice in order to foster a deeper sense of being an aviation professional. Although the researchers studied a small sample of only eight participants, their participant interviews were coded using thematic analysis against typical CoP characteristics and results suggested that the MATES CoP effectively began the process of developing the identity of a professional aviator within the students, while positively impacting their levels of aviation knowledge (Bates & O’Brien, 2013).

Team learning and the learning organization. Just as CoPs can be expected to positively impact the community members in multiple ways (Baker & Beames, 2016; Bates & O’Brien, 2013), the sharing of knowledge by organizational members may lead to the development of shared mental models (Mele et al., 2010; Senge & Sterman, 1992). According to Senge and Sterman (1992), the ways in which organizations are able to survive and thrive over time is based on the members, especially the managers, being able to accept the environmental feedback and effectively create mental models involving new ways of conceptualizing the organization that are reflective of the environment in which it operates (e.g., the market conditions or the competition for scarce resources). Stated another way, an organization's ability to learn ensures its survival (von Bertalanffy, 2008/1950).

Interested in how the learning organization concept could be applied to schools, Bowen, Ware, Rose and Powers (2007) administered a learning organization survey instrument, oriented on school success, to more than 700 school employees in North Carolina. Conducting factor analysis for two primary factors (e.g., actions and sentiments), the researchers determined that these factors were useful in evaluating schools as learning organizations and, more importantly, they concluded that when considering potential interventions, a change effort should include a collaborative effort of employees working together in supportive and inclusive ways, in addition to focusing on students (Bowen et al., 2007). Thus, professional development efforts should focus on the ways in which teachers work with one another during the throughput process.

Interventions Focused on a System's Outputs

Multiple theoretical frameworks have been used effectively in order to study the impacts of professional development on employee behavior and organizational performance, including von Bertalanffy's systems theory (Delaney & Huselid, 1996), the framework for the intervention literature presented herein. Within organizations, human resource practices, including employee training and professional development programming, should focus on improving skills and abilities of employees in order to improve organizational effectiveness (Delaney & Huselid, 1996). The success of these human resource practices, however, is often a function of what is trained, how it is trained, and how it is evaluated (Arthur, Bennett, Edens, & Bell, 2003).

Successful professional development programs for teachers and pilots share common characteristics including a focus on content, an experiential learning component, and an ability to leverage group dynamics in addition to individual-level learning. To return to von Bertalanffy's (2008/1950) organizational systems framework, a system's outputs are the product of the transformation of the raw materials received from the environment as inputs (Kast & Rosenzweig, 1972), and these outputs can include things such as sales revenue, employee performance, and employee satisfaction (Jackson & Schuler, 1995). Within teaching organizations, these outputs can also include increased pedagogical content knowledge and efficacy for teachers, and increased achievement for students (Holzberger, Philipp, & Kunter, 2013; Tschannen-Moran, Hoy, & Hoy, 1998).

Since information about the organization's outputs will ultimately be fed back to the system as an input, feedback communicates an evaluation, either positively or negatively, of the throughput process and is useful in providing information about the need for organizational change (Kast & Rosenzweig, 1972). Feedback provided by employees, either by word or deed, is especially valuable in demonstrating the need for transformational change (Jackson & Schuler, 1995). Whether manifested in an employee's change in knowledge or behavior, their attitude about the training program itself, their level of perceived organizational support, their organizational commitment, or conversely, their intention to leave, organizational outputs provide valuable output feedback (Wang et al., 2002). These outputs are discussed below.

Organizational training and behavior / knowledge change. As the proposed intervention will be focused on increasing flight instructor knowledge about non-technical skills and teaching these skills to students, the outcomes of similar training programs are especially salient. For example, recently a sample including 126 nurses and 23 emergency room doctors were given a two-day seminar designed to create an awareness of error development, error recognition, and error mitigation through teamwork (Verbeek-van Noord, Bruijne, Twisk, Dyck, & Wagner, 2015). Through mixed-model analyses, the results suggested that there was an increase in communication, enhancing professional behavior in emergency medical situations following the intervention (Verbeek-van Noord et al., 2015). Likewise, McNeill and Knight (2012) studied the impact of professional development on 70 teachers, finding that by focusing directly on their pedagogical content knowledge by addressing instructional strategies and student conceptions, the teachers' PCK surrounding the specific topic improved.

Therefore, whether situated within the aviation industry, the medical industry, or within schools, professional development programs aiming to increase knowledge, to provide new skills, or to improve behaviors either in the classroom or in the cockpit, will generally be successful, at least to a degree. As revealed by multiple meta-analyses and systematic reviews, the focus areas of various interventions have yielded results that suggest interventions can increase teachers' pedagogical content knowledge (Guskey & Yoon, 2009; McNeill & Knight, 2012) and can increase pilot knowledge, awareness, and usage of non-technical skills, subsequently increasing their use at either the individual or team level (Fletcher et al., 2002; Garden et al., 2015; Gordon et al., 2017; Hull et al., 2015; O'Connor et al., 2008; Savoldelli et al., 2006).

Organizational training and attitude change. In evaluating how military flight instructors' attitudes about aircrew coordination changed as a result of participating in a training program, Alkov and Gaynor (1991) found that naval aviators began to develop positive attitudes about the content areas. Since the concepts taught to more than 90 highly experienced flight instructors included cockpit management techniques using flight training scenarios conducted within flight simulators, it appears that an intervention for the company's flight instructors may also provide the impetus for attitude change.

In addition to attitude change that may occur within intervention participants, attitude change may also occur within those who work for, or alongside, participants. For example, Biggs, Brough and Barbour (2014) evaluated the effects of a leadership development program, both pre-intervention and post-intervention, on more than 350 leader subordinates. Using a training program focused on shaping the leaders' leadership style, communication, and strategic leadership behaviors, the researchers found that developing leadership capabilities can enhance employee engagement (Biggs et al., 2014).

Organizational training and perceived organizational support. Like attitude change, organizational training or professional development opportunities can include, among other things, workshops, seminars, web-based learning, reflecting on experiences, or establishing communities of practice (Steinert, 2010). Learning from peers in the workplace is especially valuable since it engenders collaboration (Steinert, 2005). Not all organizational training, however, can be expected to yield positive results and, interested in understanding how employees' perception of training related to organizational outcomes, Bartlett (2001) collected data from a sample of 337 nurses in large hospitals within major Midwestern cities. Through conducting correlation and stepwise regression analyses, the researcher found that access to training demonstrated a stronger relationship to organizational outcomes than the number of hours spent in training, the number of actual training events conducted, or the type of training conducted, suggesting that knowing training opportunities are available may enhance employee commitment to the organization (Bartlett, 2001). In other words, being able to participate in training may have implications for the organization beyond the content of the training and, accordingly, results from several studies suggest that simply having access to training may ultimately increase employee commitment to an organization (Ehrhardt et al., 2011) because employees sense that the organization is interested in their development.

Organizational interest in employee development will likely lead to an employee's increase in Perceived Organizational Support (POS), defined as an employee's perception of "the extent to which the organization values their contributions and cares about their well-being" (Eisenberger, Huntington, Hutchison & Sowa, 1986, p. 504). Employees' beliefs about the organization for which they work are developed when the organization provides support that includes, among other things, training opportunities (Eisenberger et al., 1986). With respect to employees participating in training, however, Tharenou's (1997) longitudinal study involving more than 5000 Australian employees, found that voluntary participation in additional organizational training was only weakly predicted by organizational factors. Further, unless employees believed that their superiors supported the training and that there was a culture of training and development within the organization, then they may not avail themselves of these opportunities (Tharenou, 1997). When superiors demonstrate this support, employees will likely feel the need to reciprocate support to the organization through increased organizational commitment, increased task performance, and heightened job involvement (Rhoades & Eisenberger, 2002).

Organizational training and organizational commitment. Although high levels of POS should enhance organizational commitment (Eisenberger et al., 1986; Rhoades & Eisenberger, 2002), Ehrhardt and colleagues (2011) researched the relationship between organizational training and organizational commitment. Subsequently, they collected data from 266 cross-functional product development teams using a cross-sectional survey designed to elicit participants' perception of training comprehensiveness and their organizational commitment. Results suggested that the more comprehensive an employee perceives the training to be, the more committed to the organization they will be (Ehrhardt et al., 2011).

Similarly, Tansky and Cohen (2001) collected perceived organizational support and organizational commitment data on 262 managers and supervisors working within a major Midwestern hospital. Using hierarchical linear regression techniques, the researchers found that perceived organizational support contributed to the prediction of organizational commitment (Tansky & Cohen, 2001). Perhaps more importantly, they concluded that by implementing an ongoing employee development process, organizations will be better able to gain and maintain a competitive advantage (Tansky & Cohen, 2001).

Perceived organizational support and job satisfaction. In trying to understand the effects of multiple organizational conditions on job satisfaction and the intention to leave, Acker (2004) studied 259 mental health agency workers in New York in order to identify organizational aspects that seemed to increase employee turnover. Finding that opportunities for professional development were associated with increased job satisfaction and reduced intention to leave, the researcher concluded that job satisfaction is largely a function of the organizational environment (Acker, 2004). Within the educational context, Bogler and Nir (2012) collected quantitative data from more than 2500 elementary school teachers in Israel in order to investigate the relationship between perceived organizational support and job satisfaction. Similar to Acker (2004), results showed that perceived organizational support was significantly related to satisfaction, leading the researchers to conclude that teacher intrinsic and extrinsic satisfaction is affected by how the teachers feel that the school cares about their well-being and values their contributions to the school (Bogler & Nir, 2012).

Perceived organizational support and turnover intention. Interested in the turnover process and identifying those factors that cause employees to leave organizations, Allen, Shore and Griffeth (2003) conducted longitudinal research, spanning one year, on a sample of 412 salespeople and insurance agents in order to understand how their ratings of perceived organizational support related to turnover intention. Through structural equation modeling, the researchers ultimately found that perceived organizational support was strongly negatively related to turnover intention. In other words, the more an employee felt that the organization supported them, the more committed to the organization they were, the higher the job satisfaction they experienced, and the less likely they were to leave (Allen et al., 2003).

Summary and Overview of Proposed Solution

Professional development opportunities within education organizations, including RWFT, can be delivered in a number of ways, from formalized group-level events to informal individual-level observations of experts teaching specific content (Steinert, 2010). Since RWFT's UH-72 flight instructors were dissatisfied with the AQIPT, and since they perceived that RWFT did not provide them valuable training activities, there was an opportunity to implement an effective intervention, designed to reconcile the gap in information about teaching the critical non-technical aircraft automation management skills as well as to improve flight instructors' perceptions about RWFT itself.

Using systems theory (von Bertalanffy, 2008/1950) as a theoretical framework, and considering a professional development program as part of the Human Resource Development subsystem (Wang et al., 2002), an effective intervention could be expected to affect both instructors and the organization. Stated another way, by providing an intervention designed to equip flight instructors with the non-technical skills that the AQIPT did not provide them (a necessary resource not provided by the external environment), it could be expected that the outputs for the instructors, including increased pedagogical content knowledge (Shulman, 1986) and improved attitudes such as perceived organizational support (Eisneberger et al, 1986), would become inputs to the organizational system that provides flight training to initial entry flight students (the organizational throughput process). Through improved knowledge about the non-technical aircraft automation management skills, flight instructors' pedagogical content knowledge may increase, a valuable focus of professional development programs for teachers (Van Driel & Berry, 2012), and this may also positively affect their teacher efficacy and, subsequently, the achievement of their students (Tschannen-Moran et al., 1998).

By reviewing literature focused on the development of non-technical skills in professional fields such as aviation and medicine, while simultaneously reviewing literature associated with professional development in general, and professional development for teachers, in particular, it was possible to develop an intervention that would address as many of the findings as practicable. For example, literature suggested that within professions demanding an ability to use the non-technical skills, successful training programs for these skills involved content delivery (e.g., lecture), experiential practice through simulation, and tangible feedback from experts (Flin et al., 2003; O'Connor et al., 2008; Salas et al., 2000). Likewise, literature associated with teacher professional development suggested that effective programs included a workshop component, provided opportunities for active teaching, and remained situated on the teachers' specific classroom environment (Guskey & Yoon, 2009; Matherson & Windle, 2017). Finally, literature associated with both education organizations and aviation organizations emphasized the value of team-based collaborative learning opportunities for practitioners (Bertram et al., 2017; Bowen et al., 2007; Salas et al., 2002; Wenger et al., 2002).

Bearing these findings in mind, an effective intervention should include workshops, delivered in small groups, focused on content delivery of key non-technical skills such as pilot monitoring and automation monitoring (Potter, Blickensderfer, & Boquet, 2014). These skills should be nested within the concepts of situational awareness, as well as workload management (Flin et al., 2003) in order to assist flight instructors in more effectively developing airmanship within their students (Ebbage & Spencer, 2004). Flight instructors should then be able to participate in facilitated discussions, led by experts about the ways to teach these non-technical skills to students (Eisenberger et al., 1986; Guskey & Yoon, 2009). Following these discussions, flight instructors should be afforded the opportunity to participate in scenario-based flight simulator training, allowing them to work in teams in order to practice teaching these skills (Salas et al., 2000; Swackhamer et al., 2009). Finally, at the conclusion of these experiential learning opportunities, the instructors should receive feedback designed to identify those behaviors that demonstrated effective use of the skills and those behaviors leading to errors (Savoldelli et al., 2006).

CHAPTER 4 - INTERVENTION PROCEDURES AND PROGRAM EVALUATION

Chapter Overview

As the previous chapter revealed, professional development may increase knowledge, skills, and abilities while simultaneously affecting perception and attitude. Based on employee dissatisfaction with the AQIPT and its lack of information about teaching non-technical automation management, coupled with employee perception that RWFT did not provide valuable training activities, there was an opportunity to develop and implement an organizational intervention that would reconcile the gap in training while also contributing to organizational functioning. Based on reviewing literature from multiple domains including professional development, education, and aviation, a theoretically powerful intervention should include facilitated discussions within workshops focused on both content and teaching, delivered in small groups, with an opportunity to participate in scenario-based flight simulations in order to practice teaching the content areas. Like many other organizations, however, RWFT exists in a constantly-changing environment and, subsequently, initiatives planned theoretically may not equal initiatives executed actually. With this in mind, this chapter provides the methodology and the contextual events, both internal and external to the organization that, from a continuous improvement standpoint, shaped the actual intervention strategy and implementation.

The Need for Continuous Improvement

As Richardson (2009) offers, context matters and that which initiates an educational activity should be understood through the context from which it emerges. Within organizations, operational conditions and contexts constantly change and it is important to recognize that, organizationally, change is normal (Tsoukas & Chia, 2002). While recognizing that change is constant, however, Crossan, Cunha, Vera, and Crossan (2005) offer that organizational interventions, at least those found in the preponderance of organizational literature, typically adhere to a rigid *clock-time* perspective, where intervention processes are executed linearly as planned.

Despite the preference for the linear execution of intervention strategies, organizations are largely affected by events, necessitating the need to situate organizational initiatives on *event-time* and, according to Crossan and colleagues (2005), this implies that there needs to be a great deal of flexibility when responding to change caused by internal or external forces. Since organizational flexibility is integral to success, and since organizations must continually adapt by scanning the environment in order to align activities with environmental demands (Murray & Chapman, 2003), it follows, then, that organizational change efforts will likely fail if the organization is unable to adapt to changing conditions (Gilley, Dixon, & Gilley, 2008).

The ability to remain flexible and adaptive implies that an organization operates with an interest in evolving and improving in order to maintain or increase its viability (Garvin et al., 2008). In order to evolve and improve, organizations must learn and, subsequently, the need for continuous learning and improvement within education organizations, according to Bredeson and Johansson (2000), must be communicated at the individual and collective levels. To facilitate this organizational flexibility and adaptability, organizational leaders are uniquely positioned to affect organizations through developing, designing, and delivering professional developmental opportunities, as well as creating an effective learning environment (Bredeson & Johansson, 2000). Perhaps more importantly, within educational organizations, leaders are the catalyst to help stakeholders understand how to move beyond stagnant paradigms in order to realize new ideas about teaching and learning (Bredeson & Johansson, 2000).

While organizational leaders set the conditions for organizational learning and flexibility, effective organizational leaders recognize not only threats, but also opportunities for improvement (Tushman, Newman, & Romanelli, 1986). Somewhat unique to an education organization, RWFT is certified to the International Organization for Standardization (ISO) 9001:2015 standard and, subsequently, is required to maintain quality and to continuously monitor and improve its processes and performance (ISO, 2015). Codified within the standard itself, an organization must understand its context and, though this understanding, should identify opportunities for improvement and take action to better satisfy its customer (ISO, 2015).

As originally conceived, the intervention would address, and potentially remediate, an opportunity for improvement situated on enhancing flight instructors' awareness of nontechnical aircraft automation. With any professional development program, however, precise planning and coordination is necessary in order to ensure that the best possible outcomes are achieved (Guskey & Yoon, 2009) In fact, when there is sufficient time and very little environmental uncertainty surrounding the organization, organizational leaders have the luxury of planning and implementing interventions as envisioned (Crossan et al., 2005). Conversely, when significant environmental uncertainty exists, organizational leaders may experience a sense of urgency and a lack of time to plan. Regardless of the organizational contexts or circumstances, Crossan and colleagues (2005) remind organizational leaders that if they fail to take action when necessary, not only will the organization have missed an opportunity to correct a deficiency, but also the problem may increase.

In the case of RWFT, multiple events and contextual issues within the organization and within the environment created the need to respond in the moment in order to capitalize on opportunities for improvement. Specifically, from the time that the author assumed the role of organizational leader and conducted the initial needs assessment (April 2017) to the time of formal approval to conduct the study (November 2018), the organization endured multiple sources of change, both internally and externally, that influenced the context of the intervention and its eventual implementation.

Internal Events

Following the needs assessment, issues such as a government-directed contract modification to increase the annual number of students that RWFT would be required to teach ultimately increased the number of flight instructors required. Subsequently, the need to continually hire flight instructors affected the flight instructor demographic. Simultaneously, a spate of aircraft incidents required RWFT leadership involvement that resulted in additional onboarding training for new employees. The impacts of these internal events are described below.

A changing flight instructor demographic. Beginning in fiscal year 2018 (October 2017), the government increased the IERW student throughput requirements, requiring RWFT to employ more flight instructors. Simultaneously, RWFT, partially due to a retirement-eligible workforce, many of who had been teaching IERW for decades, and competition with the aviation industry for a limited number of potential employees, experienced a larger than normal turnover. Specifically, from April 2017 through November 2018, RWFT on-boarded a total of 133 flight instructors while losing a total of 107 flight instructors. Each of these newly hired flight instructors had experience flying technically advanced aircraft, although not teaching initial entry students. In other words, these newly-fired and qualified instructors were familiar with the cockpit workload demands associated with operating technically advanced aircraft.

Aircraft incidents. As RWFT worked to increase its density of UH-72 flight instructors in order to meet increased teaching requirements, the Company experienced several aircraft incidents in fairly rapid succession. While none were catastrophic, root-cause analyses suggested that instructors either forgot or didn't apply the correct procedural requirements, mismanaged the cockpit workload during an incident, or reverted to flight behaviors inconsistent with those associated with flying technically advanced aircraft (e.g., trying to fly *single pilot* without utilizing the entire crew).

A clear example of these phenomena occurred on December 4, 2017 when a flight instructor was involved in a mishap that demonstrated, firsthand, a deficit in non-technical aircraft automation management skills and, in particular, those non-technical skills involving workload management and pilot monitoring. Captured in RWFT's quarterly safety letter, the flight instructor described the situation by offering that:

> my thirty-five years of single-engine experience overwhelmed the 200 hours of experience in the multi-engine aircraft [and] rather than involving the entire crew, I was preoccupied with the 'dead engine' and trying to restart it than focusing on the operational systems (RWFT Safety, 2018, p. 3)

Additional follow-on training. RWFT business practices have long established that when an instructor is involved in an accident or incident, and prior to returning to teach students, they will undergo tailored training with a Methods of Instruction Standardization Instructor. Lasting from one to several days, the tailored training is designed to allow the instructor to recreate the incident and to remediate any lapses in pilot behavior if warranted.

As a result of the December 4, 2017 incident addressed above, the remediation efforts focused on non-technical skills usage within in a scenario-based environment, created in both the UH-72 flight simulator and the actual aircraft. Demonstrating the power of these efforts, the instructor stated that the "one-on-one training with a Standards IP that the Company provided was the best training I have experienced in a long time" (RWFT Safety, 2018, p. 3). Based on these comments and through discussions with the Standardization Division, the author directed that all newly-hired instructors receive the same type of training, once they completed the AQIPT course, prior to teaching students.

External Events

Although contractually required to analyze academic and flight training outcomes (Mission Installation Contracting Command [MICC], 2018), RWFT is also required to provide input to the government about all of its training materials, including syllabi, so that these materials can be adapted in such a way to ensure customer satisfaction. Since the government provides the resources necessary to facilitate flight training, as well as the explicit directives outlining the delivery of flight training (MICC, 2018), however, RWFT depends on its environment to provide resources and feedback (see von Bertalanffy, 2008/1950; Wang et al., 2002). Following the initial needs assessment, these resources and feedback involved multiple changes to the IERW curriculum, aircraft shortages, and resultant overtime requirements. The impacts of these external events are described below.

Changes to the IERW curriculum. According to Mandinach (2012) the use of data is important for practitioners in identifying strengths and weaknesses of students and for school leaders in identifying whether or not programmatic changes such as curriculum adjustments create results. As Marsh and colleagues (2006) suggest, it is important to utilize all types of data in order to guide decision-making and to improve school success. Through its decades of unabated student throughput, RWFT is uniquely positioned to provide this data in order to influence policy related to flight training. As mentioned, however, within the IERW flight training enterprise, the government retains all decision-making authority and will not allow RWFT to execute any training without its express consent (MICC, 2018), despite the real possibility that the government lacks the expertise to determine that causes of performance (Wohlstetter et al., 2008). In other words, while RWFT can identify opportunities for curriculum modification, it cannot implement any change without approval.

According to Bardach (2012), during times of rapid change and diminished predictability, it is important to receive information from those within the organization who are directly affected by the changes. The introduction of the UH-72 as the initial entry training helicopter created rapid change and reduced predictability, and RWFT flight instructor feedback about teaching students to fly in this aircraft became salient. Stated another way, rapid curriculum changes necessitated that new collaborative relationships form within the flight training enterprise (Honig, 2006). Specifically, through the efforts of curriculum review working groups, comprised of RWFT flight instructors, management personnel, and governmental quality assurance flight evaluation personnel, feedback resulted in multiple changes to the initial entry rotary wing course management plan and syllabus (USAACE, 2018). While not all feedback or proposed revisions were ultimately adopted, since its inception, the UH-72 IERW curriculum had undergone revision more than six times.

Aircraft shortages. Despite organizational efforts aimed at hiring flight instructors with a higher degree of experience in flying technically advanced aircraft, providing additional on-boarding training, and influencing multiple curriculum changes designed to facilitate more coherence in the IERW program, a systemic issue involving resource constraints began to affect the flight training enterprise in general, and RWFT in particular. Specifically, the context in which RWFT instructors taught students began to change in July 2018 when the availability of flyable aircraft decreased. Specifically, according to RWFT's Director of Training, between July 2018 and November 2018, more than 1700 aircraft, representing more than 5,000 student flight hours, were not provided as scheduled.

In addition to placing students and instructors behind schedule, these aircraft shortages affected the way in which RWFT provided its flight training services. Instead of flying with students each day, as required by the syllabus, it became common for students to fly only two to three times per week. Subsequently, RWFT flight instructors were unable to provide their students meaningful and frequent repetition to help build their aviation knowledge and psychomotor skill, an expectation within the aviation training industry (Henley, Wiggins, Bye, & Turney, 2003). Perhaps more critical, the lack of training resources, according to RWFT's Director of Quality, began to affect student grades and began to cause them to complete their training behind schedule.

While many organizations, according to Gilley and colleagues (2008), only superficially try to bring about change while hoping that the impetus for change disappears, weekly aircraft maintenance reports indicated that these issues would persist into the future, according to RWFT's contracting officer representative. In other words, the aircraft shortages created a backlog in throughput and placed RWFT flight instructors in a precarious posture, when provided an aircraft, to fly in excess of syllabus requirements (USAACE, 2018) in order to make up lost flight time.

A weary workforce. Almost as soon as the aircraft shortages began to appear, the government authorized and encouraged RWFT to conduct additional flight training vis-à-vis the use of overtime. According to Goldenhar, Hecker, Moir, and Rosecrance (2003), however, hazardous jobs should avoid overtime requirements, if at all possible. For RWFT, typical overtime shifts are conducted during the opposite flight training periods (e.g., morning and afternoon flight training shifts) during the weekdays, but the government also mandated that RWFT fly on selected Saturdays and expected RWFT flight instructors to volunteer additional shifts during those Saturdays that were not mandated, if flight classes were behind. Despite significant overtime opportunities, however, RWFT flight instructors began to opt out of volunteering, citing, similar to Goldenhar and colleagues (2003) findings, significant disruption of family and social activities, fatigue, and the increased risk of issues compromising crew safety. Stated another way, the increased operational tempo decreased the likelihood of participating in organizational activities beyond the normal flight training shift, including a multi-day professional development program.

Research Design

The design that the intervention ultimately followed was shaped by the internal and external events, described above, that affected the organization over the 18+ months following the needs assessment discussed in Chapter 2. Over this period, multiple initiatives were necessary, from a continuous improvement perspective, that ultimately influenced the intervention's implementation. Based on its outcome orientation, its focus on research questions, and its approach to collecting data through using the most practical techniques, however, this study was aligned with the pragmatist worldview, which offered the ability to combine both quantitative and qualitative data in order to effectively address the factors under investigation

(Creswell & Plano Clark, 2011). In other words, since pragmatism presumes that quantitative and qualitative processes can complement one another, the advantages and disadvantages inherent in each can be leveraged appropriately in order to determine the things that make a difference and to better understand the phenomena (Shannon-Baker, 2016).

In order to determine how the intervention affected the flight instructors as teachers and as organizational employees, the researcher used a fixed method, sequentially timed, explanatory design as described by Creswell and Plano Clark (2011). Specifically, data collection followed a pre-planned process whereby quantitative data capturing flight instructors' POS, teacher efficacy, and perception of learning organization functioning were to be collected prior to the collection of any qualitative data. Since the researcher focused first on the quantitative phase with the intention of using those results to inform the qualitative research questions and data collection, this followed the follow-up explanations variant of the explanatory design (Creswell & Plano Clark, 2011).

Primary Research Questions

Providing the launch point for the intervention, the following overarching research questions formed the basis of the investigation:

(1) Did the intervention improve UH-72A flight instructors' content knowledge?

(2) Did the intervention improve the UH-72A flight instructors' perception of RWFT?

In order to answer these questions and to assess the impact of the program, Newcomer, Hatry, and Wholey's (2010) continua for selecting an evaluation approach was useful. Although there would likely be opportunities to improve the delivery of the intervention while it was "in stride," indicating the potential for a formative evaluation, the evaluation was focused on the outcomes and impacts of the intervention. Subsequently, this study located along the summative approach end of the continuum (Newcomer et al., 2010). Since the participating flight instructors were already teaching students within the new aircraft, and since one of the primary objectives was to standardize flight instructor content knowledge about the non-technical skills, the study was also envisioned to be one-shot in nature (Newcomer et al., 2010) in order to determine whether the program actually did standardize content knowledge across the organization.

Whether or not the study identified program effectiveness was, however, a function of three conditions, including ensuring that the program's objectives were well-defined and plausible, and that there was a plan for the use of information (Strosberg & Wholey, 1983). In other words, it was important that those responsible for the development and implementation of the program had an understanding, based on evidence, of the specific objectives or indicators associated with the outcomes of the program. In the case of the flight training organization, MICC (2018) has specified that the author, as the leader of RWFT, maintains sole responsibility for obligating RWFT on all matters, including conducting the analysis of all academic and flight training without Government supervision or control. As such, the decisions rested squarely with the author, but despite enjoying significant control over the intervention, environmental stability and other effects were uncontrollable.

Theory of Treatment

Although non-technical aviation skills training were envisioned to reconcile issues for UH-72 flight instructors, it was important to first identify those issues that needed be treated, those who needed to be treated, and how they should be treated (Leviton & Lipsey, 2007). In order to articulate the ways that an intervention affected outcomes, the author developed a theory of treatment, based on Leviton and Lipsey (2007), that (1) clearly defined the problem; (2) defined the treatment; (3) described the ways in which the treatment would deliver its effects;

and (4) clearly defined the outcomes by identifying the effects that should be occur as a result of the treatment.

To reiterate, the UH-72 flight instructors' problem (e.g., treatable condition) included organizational dissatisfaction and a lack of knowledge about non-technical aviation skills due to a lack of training. To target these conditions, the treatment focused on what needed to happen in order to produce the results (Leviton & Lipsey, 2007). Through these focal areas, the author concluded that an ingredient capable of treating both of these conditions simultaneously involved providing professional development because these programs have the ability to shape organizational attitude and climate (Tharenou, Saks, & Moore, 2007) and have been shown to help teachers gain increased content knowledge and heightened awareness for the teaching this content (Garet, Porter, Desimone, Birman, & Yoon, 2001).

The program included four primary content areas intended to have several effects. For example, in educational settings, programs that focus on content, situate within the teachers' context, and provide opportunities for hands-on practice, are likely to enhance knowledge and skill (Garet et al., 2001) which can be expected to increase teachers' pedagogical content knowledge (Shulman, 1986; Van Driel & Berry, 2012). Increased PCK has been shown to increase teacher self-efficacy (Swackhamer et al., 2009; Tobin et al., 2006; Tschannen-Moran et al., 1998), which may ultimately affect student outcomes positively (Baker & Beames, 2016; Holzberger et al., 2013; Tschannen-Moran, Hoy, & Hoy, 1998). Likewise, in business settings, simply having access to training may improve employee perceptions about their organization (Bartlett, 2001; Bulut & Culha, 2010; Ehrhardt et al., 2011; Lee & Bruvold, 2003), including their perceived organizational support (Eisenberger et al., 1986) which may contribute to increased commitment, task performance (Bartlett, 2001; Rhoades & Eisenberger, 2002; Tansky

& Cohen, 2001), job satisfaction, decreased turnover intention (Allen et al., 2003; Bogler & Nir, 2012; Bulut & Culha, 2010; Tharenou et al., 2007) and, ultimately, a more positive organizational climate (Gelade & Ivery, 2003). These outcomes were represented through a causal diagram (see Figure 5 below).

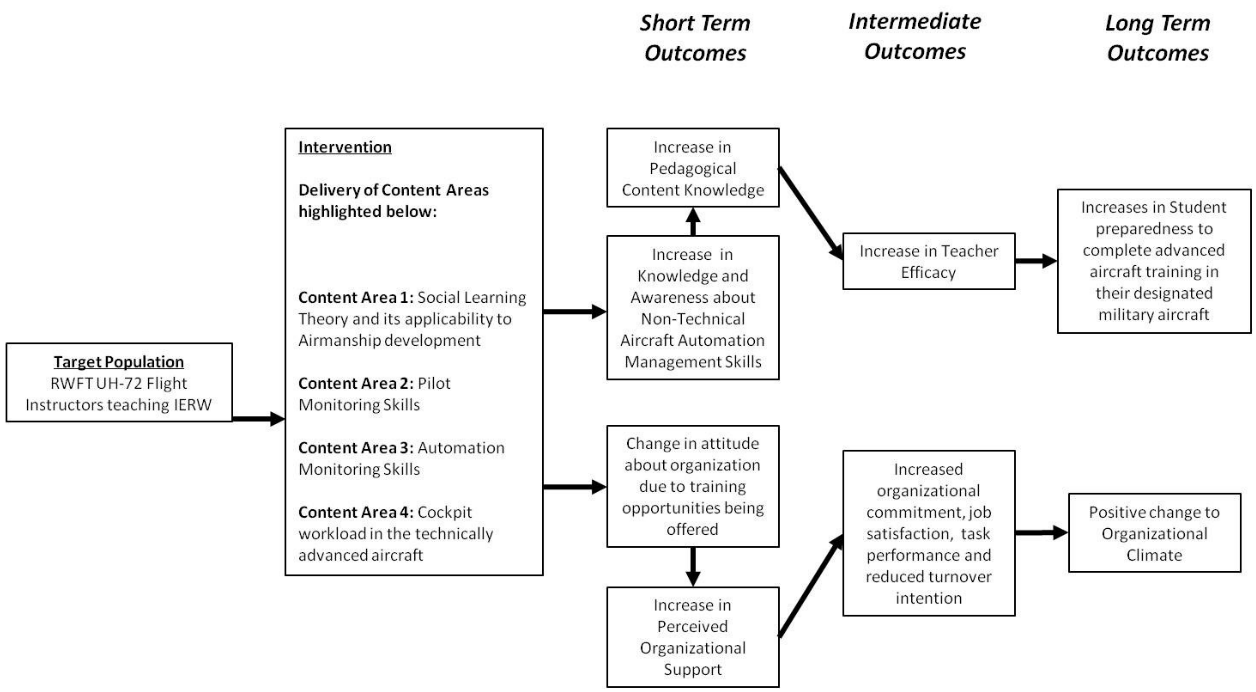

Figure 5. Causal Diagram Representation of Theory of Treatment

Logic Model

A logic model (see Figure 6 below) representing resources required to support the intervention, activities required to create the products used by the participants, and changes expected as a result of participation, was useful to identify issues that may enhance the likelihood of program benefit (Cooksy, Gill & Kelly, 2001; McLaughlin & Jordan, 1999). In this case, although the organization had access to all resources, staff members needed to allocate significant time to research the content areas in order to create the products that formed the basis of the intervention.

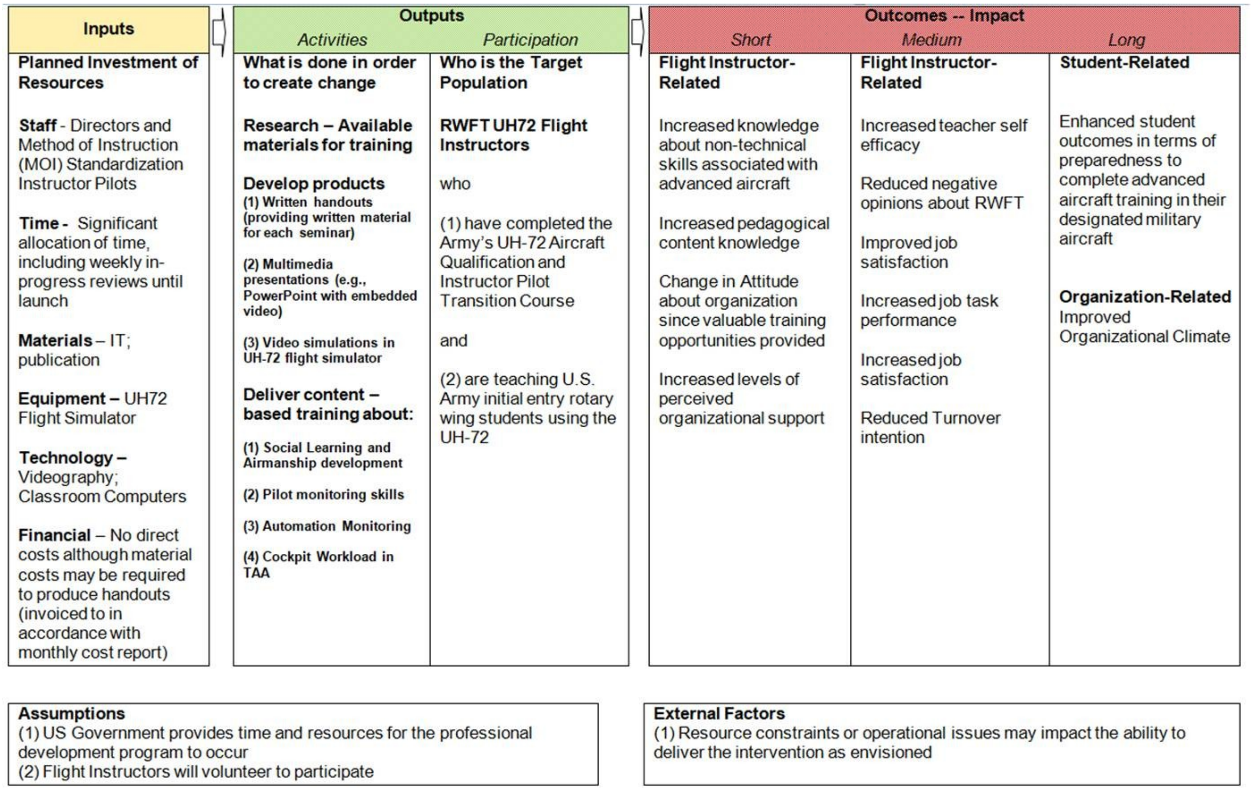

Figure 6. Logic Model

Alignment Between Theory of Treatment and Logic Model

The theory of treatment causal diagram and the logic model were aligned, but there were issues that need to be addressed. First, the program was intended for all UH-72 flight instructors, but some had prior experience in TAA while others did not, which created a situation where some instructors would likely benefit more than others since some would not have had the problem in the first place and, subsequently, would likely not be helped as a result of it (Leviton & Lipsey, 2007). Second, there was no clear linkage between the lack of knowledge about the non-technical skills and organizational dissatisfaction, although the intervention was envisioned to reconcile both simultaneously. In other words, some flight instructors may have lacked non-technical skill knowledge but may have had positive attitudes about the organization and vice versa. This could affect the ability to understand the effects of the treatment. Finally, the notion that increases in perceived organizational support would be synonymous with organizational variables (e.g., turnover intention, performance, commitment, etc.) and, ultimately, improved organizational climate over-stated the potential impact of the program (Leviton & Lipsey, 2007).

As the theory of treatment suggested, the intervention program was expected to create demonstrable outcomes within the short and intermediate terms, both at the individual flight instructor level and at the organizational level. Although long term outcomes could likewise be expected, the duration of the study prohibited the collection of data and, as a result, the long term outcomes were not evaluated.

Outcomes. Prior research suggests that professional development for teachers can increase teaching efficacy (Fritz et al., 1995; Martin et al., 2008; Ross & Bruce, 2007; Watson, 2006) and, perhaps more importantly, Swackhamer and colleagues (2009) found that teacher efficacy can be increased through increasing content knowledge and pedagogical awareness, the main effort of the intervention for UH-72A flight instructors. Since the intervention provided content-based information, it was expected that the flight instructors' knowledge would increase and this increased knowledge was expected to influence their teacher efficacy and pedagogical skill (Bandura, 1977; Shulman, 1986; Tschannen-Moran et al., 1998).

Additionally, organizational outcomes such as increased perceived organizational support (Eisenberger et al., 1986), increased organizational commitment (Ehrhardt et al., 2011), and heightened job involvement (Rhoades & Eisenberger, 2002) were also expected to increase. Organizationally, the expected increase in POS was envisioned to influence the ways in which the flight instructors viewed the organization in general. Since the intervention was developed by members of management, it was expected that if supervisors encouraged the learning of the content within the program, then the flight instructors would attribute their supervisor's behavior to the organization and, subsequently, the perception of the importance of organizational learning also would emerge (Bartlett, 2001; Bogler & Nir, 2012). Stated another way, the flight instructors would likely attribute characteristics associated with a *learning organization* to the Company since the organization facilitated employees' learning (Davis & Daley, 2008; Kontoghiorghes et al., 2005).

Process Evaluation

Prior to determining whether or not the intervention yielded the outcomes described above, it was necessary to ensure that the intervention was delivered as intended. Accordingly, the following process evaluation components included the implementation of the program and the context of the program.

Implementation of the program. Although Linnan and Steckler (2002) offer that the implementation of a program is typically a "combination of reach (who participated), dose (what the program delivered), dose received (what participants received), and fidelity (the quality of the intervention delivered)" (p. 14), the implementation of a program is focused on how closely the program was delivered in the way it was designed (Baranowski & Stables, 2000). Before determining what constituted acceptable implementation, however, it was important to first identify a realistic score based on similar interventions discussed within the literature (Linnan & Steckler, 2002). In this case, due to a lack of existing literature associated with pilots flying technically advanced aircraft and interventions focused on providing these non-technical skills to them, the implementation of the program is conceptualized to mean that UH-72 flight instructors received each of the four content areas identified within the logic model and the theory of treatment.

Context. The context in which an intervention takes place is particularly important for understanding not only the target population but also for understanding how the results may be generalized (Baranowski & Stables, 2000). Recognizing the effect of context that had on the organization since the initial needs assessment, this was particularly important. Subsequently, the contextual underpinnings included not only those internal to the organization (e.g., participants' previous experience flying technically advanced aircraft), but also those external to the organization (e.g., environmental influences not within organizational control).

Process evaluation indicators. In order maximize the likelihood that the intervention contributed to the outcomes articulated in the logic model and the overall theory of treatment, certain process indicators were used to determine whether the intervention was implemented as planned. These process indicators served to establish whether or not the intervention was implemented with fidelity even prior to determining if the intervention was effective (Saunders, Evans, & Joshi, 2005). In this case, process indicators included (1) the quality of the materials distributed to the participants in advance and provided during the seminars; (2) the participants' engagement in seminar content; and (3) the preparedness of the seminar facilitators. Each of these indicators is discussed below, and the methods by which these indicators will be collected are provided in Appendix 4.

Quality of materials. Involving aspects of *implementation*, *participant responsiveness*, and *differentiation* (Dusenbury, Brannigan, Falco & Hansen, 2003; Linnan & Steckler, 2002), participants were asked to complete a brief satisfaction scale, designed to elicit opinions about the quality of materials used throughout the program. As shown in the logic model, significant resources (inputs) and activities (outputs) were necessary to create the products that were used. In order to determine whether the materials were easy to understand, were useful, were interesting to the participants, and were not redundant, a brief satisfaction scale was used to identify those components that were worthwhile and those that were not.

Engagement in seminar content. Related to the *dose received* aspect of program implementation (Linnan & Steckler, 2002), the extent to which the participants were engaged in the seminars, actively participated in the seminars, enjoyed the seminars, and were satisfied with the content could be collected through participant self-report, teacher observation, or focus group interviews (Saunders et al., 2005). In this case, the organization relied on self-report.

Preparedness of facilitators. The extent to which the facilitators were prepared to successfully implement the intervention would be critical to the success of the program. Specifically, the facilitators' preparedness would be expected to enhance the implementation of the program in terms of its *fidelity* and its *dose delivered* (Linnan & Steckler, 2002). The logic model allocated a significant amount of time for research and development in order to make the materials that formed the intervention's content. In order to understand the ways in which facilitator preparedness affected participants, the participants' perspective of the overall manner in which facilitators contributed to their experience (e.g., enthusiasm, confidence, content knowledge, ability to respond to questions, etc.). To do this, the Director of Quality collected generalized data, devoid of personally identifiable information, about facilitator knowledge and the overall quality of the content.

Outcome Evaluation

As described earlier, the intervention model assumed that by providing a well-implemented, relevant, and applicable intervention, participants would potentially benefit in a number of ways. Specifically, as a result of the intervention, targeted outcomes for these flight instructors included increased knowledge about the non-technical skills, increased teacher efficacy, increased levels of perceived organizational support, and changes in their attitudes about RWFT. The extent to which these changes occurred, and the magnitudes of these changes if they did occur, however, needed to be understood prior to discussing the efficacy of the program. Therefore, in order to evaluate the intervention's effectiveness, several answerable questions, through which program performance could be judged, were developed (Rossi, Lipsey, & Freeman, 2004). Since the program was primarily focused on outcomes, these questions focused on impact assessment and whether the intervention contributed to its intended outcomes (Rossi et al., 2004).

Evaluation questions.

(1) Did the intervention affect participant knowledge about the non-technical skills?

(2) Did the intervention affect teacher self-efficacy?

(3) Did the intervention affect participant perception of RWFT functioning as a learning organization?

(4) What were the participants' perceptions of Perceived Organizational Support (POS) and were any of the study variables (e.g., flight experience, teacher self-efficacy, and learning organization) predictive of it?

Hypotheses. Although question 4 above was an exploratory question designed to further describe the participant sample, for the first three questions above it was hypothesized that the intervention would lead to increases in participants' knowledge, teacher self-efficacy, and perceptions of RWFT functioning as a learning organization. Statistically, these hypotheses were examined in the alternative form indicating that there would be statistically significant differences in the variables as a result of the intervention. Since the hypotheses were directional, one-tailed alternative hypotheses were evaluated. These hypotheses were expressed as follows:

Hypothesis 1. There will be a statistically significant increase in knowledge about the non-technical skills as a result of the intervention as shown through comparison of means [Ha: $\mu_{Non\text{-}tech\_Knowledge\_Posttest} > \mu_{Non\text{-}tech\_Knowledge\_Pretest}$].

Hypothesis 2. There will be a statistically significant increase in teacher self-efficacy as a result of the intervention, compared to the comparison group as shown through comparison of means [Ha: $\mu_{Teacher\_Efficacy\_Intervention} > \mu_{Teacher\_Efficacy\_Needs\ Assessment}$].

Hypothesis 3. There will be a statistically significant increase in perceptions of RWFT functioning as a learning organization as a result of the intervention, compared to the comparison group as shown through comparison of means [Ha: $\mu_{LO\_Intervention} > \mu_{LO\_Needs\ Assessment}$].

Effect size. Although there were no specific studies associated with providing a non-technical skills training program to flight instructors, the magnitudes of change reported in similar studies were worthwhile (Rossi et al., 2004). Since significant research existed that involved professional development programs, transfer of training, and teacher efficacy, these focus areas were useful in illustrating the magnitude of change in the variables that could be considered important. More precisely, according to Hill, Bloom, Black and Lipsey (2008), when no specific empirical research exists to guide the effect size determination, it is useful to turn to effect sizes reported for similar types of interventions, particularly meta-analyses, if available.

Within aviation training, meta-analyses focused on crew resource training programs have shown large effect sizes when evaluating pilot attitudes (d_{mean}=.94) about the training and pilot behaviors (d_{mean}=1.18) resulting from the training, while pilot knowledge (d_{mean}=.59) gained as a result of training shows a moderate effect (O'Connor et al., 2008). Conversely, Blume, Ford, Baldwin, and Huang (2010) suggest that training interventions yield only small to moderate effect sizes, with those studies conceptualizing transfer of training to equate to use demonstrating effect sizes slightly higher than for those studies conceptualizing transfer of training to equate to effectiveness (e.g., $d_{meanUSE}$=.36 versus $d_{meanEFFECTIVENESS}$=.10). Finally, with respect to perceived organizational support, Rhoades and Eisenberger (2002) found that when reviewing more than 70 studies, training as an antecedent to perceived organizational support demonstrated a small effect size (d_{mean}=.24). Collectively, these results suggested that since the effect sizes ranged from small to large, it was useful in this case to adhere to the conventional guidelines for a medium effect size of .50 standard deviations (Hill et al., 2008; Rossi et al., 2004).

Mimumum sample size. Based on using a significance level or probability of Type I error (α) =.05, a probability of Type II error (β) = .10, and Effect size (ES) = $1/2\sigma$, the minimum sample size is calculated to be 28 participants using the formula $[(Z_\alpha+Z_\beta)(\sigma/ES)]^2$, verified through the G*Power software. If, however, the effect size were reduced to .24 standard deviations, based on perceived organizational support effects (Rhoades & Eisenberger, 2002), then the minimum sample size would have needed to increase to more than 142 participants, more than half of the target population.

Evaluation design. The outcome evaluation oriented on whether the intervention, affected participants' knowledge, teacher self-efficacy, and perceptions of organizational support. Following a quasi-experimental design (Shadish, Cook, & Campbell, 2002), data collection followed a pre-planned process such that quantitative data was collected prior to qualitative data.

Strengths and limitations of design. Although the randomized control trial (RCT) is considered an optimal method in evaluation research because it eliminates selection bias (Torgerson, Torgerson, & Taylor, 2010), its use is not always practical or warranted. Since RCTs require that the intervention be provided to the experimental group while it is not provided to the control group, this may ultimately keep valuable treatments from those who need them (Shadish et al., 2002). In this case, the intervention was expected to ultimately help flight instructors with their flight instruction skills and, therefore, the author considered that choosing not to provide the intervention to some of the flight instructors was not a viable option.

In the typical quasi-experimental design using control groups, the groups are considered nonequivalent if they weren't formed through random assignment (Rossi et al., 2004), creating selection bias by default (Shadish et al., 2002). If groups exhibit differences in pretest measures, then it is likely that selection bias would interact with other threats, undermining the design (Shadish et al., 2002). These threats included, among others, maturation (e.g., flight instructors gain more experience in flying technically advanced aircraft and using non-technical skills even without the intervention) and history (e.g., a significant event, such as an aircraft accident, occurs during the intervention.

Method

Participant Recruitment

The target population for the intervention included RWFT UH-72 flight instructors teaching the initial entry military flight students. There were no considerations with respect to age, ethnicity, or gender in the participant recruitment process. Instead, eligibility to participate was based on the following criteria: participants must be RWFT flight instructors who (1) have completed the UH-72 Aircraft Qualification Instructor Pilot Transition (AQIPT) course; (2) were currently teaching initial entry rotary wing student pilots using the UH-72A Lakota helicopter; and (3) were nonexempt employees covered under the collective bargaining agreement between RWFT and the flight instructor union.

Employees who were scheduled but had not yet completed the UH-72 AQIPT course, and those employees who previously declined training in the aircraft altogether, were excluded from the study. Likewise, management personnel (e.g., flight commanders and assistant flight commanders) and Standardization Instructor Pilots serving within the Methods of Instruction section of the Division of Standardization were not eligible for participation. Representatives from RWFT's human resources and quality division recruited participants by announcing the opportunity to participate and by distributing materials so that flight instructors could participate.

Instrumentation

Instrumentation included two instruments. First, in order to collect process indicator data, as well as to determine the effect of seminar content on knowledge increase across several areas, a seminar feedback form was used (see Appendix 2). Containing two parts, this form included a brief satisfaction survey on Part 1 (4 questions rated on a 4-point Likert scale). Part 2 included a brief knowledge rating along five areas (e.g., conceptualization of airmanship, the ways in which observational learning may promote airmanship development, etc.) that elicited respondents' level of knowledge prior to the seminar and after the seminar. Ratings were along a five point scale, ranging from 1 (very low = don't know anything about topic) to 5 (very high = know almost everything about this topic).

Second, the intervention survey instrument, in addition to four demographic questions, contained 39-items designed to elicit participant's perceived organizational support (POS), perceptions of RWFT's functioning as a learning organization, and teacher self-efficacy (see Appendix 3). The items, rated on a 5-point Likert scale, measured the participant's POS (an 8-item scale, based on Rhoades and Eisenberger's (2002) short version of the POS Scale), teacher self-efficacy (9-item scale, adapted from Hoy and Woolfolk's (1993) Teacher Sense of Efficacy

Scale (Short Form)), and perception of learning organization functioning (22-item scale, adapted Garvin et al.'s (2008) 30-item Learning Organization Survey and Kontoghiroghes et al.'s (2005) 108-item learning organization questionnaire).

Procedure

Intervention. The extent to which organizations implement change at both the policy-level and the implementation-level requires that those who a required to implement the change manage it by reconciling the impacts to their operational contexts (Honig, 2006). According to Bardach (2012), how well the implementation is instituted depends on the extent to which stakeholders facilitate the policy change. In the case of RWFT, the implementation of the proposed intervention would follow the same trajectory.

As Crossan and colleagues (2005) suggest, successful organizations are able to effectively improvise in order to overcome adversity. Organizational improvisation is considered to be the intersection between planning for an event and experiencing an opportunity to take action that may not necessarily be in accordance with the plan (Crossan et al., 2005), and RWFT was poised to react to the changing context in order to capitalize on opportunities for quality improvement. After all, when facing crisis, inaction leads to failure (Tushman et al., 1986).

While the lack of flyable training helicopters negatively affected the context of flight training, Mourshed and colleagues (2010) offer that when mitigating the effects of a crisis in an educational system, change agents must be skilled at demonstrating how the reforms will reconcile the crisis. In the case of RWFT, the starting point involved one of organizational upheaval, exacerbated by significant training resource constraints, frequent updates to curriculum guidance, and a changing workforce. Despite this, the topics of the intervention (e.g., airmanship development through observational learning, pilot monitoring, automation monitoring, and cockpit workload), remained as important as they were after the initial needs assessment. Based on multiple contextual issues, however, the components of the intervention were delivered, via a formalized safety stand-down, to the entire RWFT flight instructor population (e.g., instructors teaching in all aircraft types), and the publication of a company-proprietary book of best practices, to only the UH-72 flight instructors.

Safety stand-down. According to the Occupational Health and Safety Administration (OSHA), a safety stand-down is an organizational opportunity for leaders to discuss safety concerns with employees (OSHA 2018). Similarly, within the military aviation context, safety stand-downs are a method through which leaders can communicate these concerns and provide necessary training to their organizations as a whole. On October 22nd, 2018 the author, in his capacity as the leader of RWFT and with the support of its military customer, conducted a Safety Stand-down. As is typical for aviation organizations, the stand-down involved no flight operations during the day and, instead, oriented on organizational discussions related to operational safety, lessons learned, and areas for improvement. Over the course of eight hours, these topics included current trends in the delivery of flight training, the current conceptualization of airmanship, the concept of observational learning as it related to developing airmanship in initial entry flight students, and best practices in flight training.

Book of best practices. According to Honig and colleagues (2014), leaders of educational organizations who have a background in teaching appear integral to gaining more support with innovative, research-based ideas. Subsequently, at the direction of the author, the Methods of Instruction Standardization Instructor Pilots developed a publication that was envisioned to not only standardize flight training techniques intra-organizationally, but also to provide a rationale for the teaching of tasks in certain ways. After all, when implementing low-cost curriculum reform, such as materials developed by experts, there is often a very high return on investment (Boser, Chingos & Straus, 2015).

Although the general contents of this book of best practices were discussed during the Safety stand-down, copies of it were delivered to RWFT UH-72 flight instructors during the next several days. This book of best practices, envisioned to provide its readers information about teaching initial entry students with the UH-72, included information and teaching techniques for each phase of IERW training, information differentiating teaching within non-modernized aircraft and technically advanced aircraft, information about automation selection, information about cockpit workload during emergency situations, and pilot monitoring tips to assist flight instructors in assisting initial entry flight students understand the information that they are receiving in the cockpit environment. Perhaps more importantly, the book provided multiple scenarios that could help instructors teach and demonstrate both technical and non-technical skills to their students.

Data Collection. Data were collected through (1) feedback forms disseminated to flight instructors following the Safety stand-down seminars and (2) through the intervention survey instrument provided to flight instructors who volunteered to participate in the study.

Safety stand-down feedback. The day following the Safety Stand-down training, the organization's Director of Quality, as part of the recurrent quality improvement requirement associated with its ISO 9001:2015 certification, disseminated a voluntary feedback form to the attendees designed to elicit, without any personal identifiable information, their reactions to the training, their self-reported knowledge increases as a result of the training, and any topics for discussion during subsequent stand-down training days (see Appendix 2).

Intervention survey instrument. Approximately three months after the Safety stand-down and the dissemination of the book of best practices, participants completed a survey instrument designed to elicit their perceptions of organizational support, the perceptions of their teaching efficacy, and their perceptions of the extent to which the company operated as a learning organization (see Appendix 3).

Data Analysis. Data analysis involved four distinct efforts, involving an analysis of feedback from the safety stand-down, an analysis of participants' intervention survey instrument responses, and an analysis comparing the scale scores of the intervention survey instrument to the scale scores of the needs assessment survey instrument (e.g., teacher efficacy scales and learning organization scales). First, data from the Safety stand-down feedback forms were analyzed in order to gain a sense of the process evaluation indicators (e.g., quality of materials, preparedness of facilitators, and engagement of seminar content) through descriptive statistics. Second, in order to examine the first evaluation question (did the intervention affect participant knowledge about the non-technical skills?), paired sample t-test procedures were conducted to determine whether the flight instructors perceived that their knowledge changed as a result of the seminars. Third, in order to examine the second and third evaluation questions (did the intervention affect teacher self-efficacy? and did the intervention affect participant perception of RWFT functioning as a learning organization?), one-sample t-test procedures were performed to determine whether the sample differed statistically from the normative values identified during the needs assessment. Finally, in order to examine the fourth evaluation question (what were the participants' perceptions of Perceived Organizational Support (POS) and were any of the study variables predictive of it?), hierarchical linear regression was performed in order to determine if the demographic, learning organization, or teacher self-efficacy variables contributed significantly to its prediction

Summary Matrix. In order to ensure that each of the research questions was addressed, including those that were focused on process evaluation and those that were focused on outcome evaluation, a matrix demonstrating the alignment between the research question, the variables of interest associated with the research question, and the method through which data were collected is shown in Appendix 4 (Process Evaluation) and Appendix 5 (Outcome Evaluation).

CHAPTER 5: FINDINGS AND DISCUSSION

Chapter Overview

The previous chapter outlined the development, implementation, and evaluation of a research design that was envisioned to, according to its theory of change, increase RWFT flight instructors' awareness of nontechnical aircraft automation management skills in order to better prepare them to teach initial entry flight students. Conceptualized to increase flight instructors' knowledge while simultaneously affecting their perceptions of organizational support, this study, if successful, would provide evidence substantiating the inclusion of the program's components into RWFT's new-employee training/onboarding program. The results of this study, along with its implications and limitations, are discussed below. Based on the implications and limitations, future research directions are likewise provided.

Summary of Findings

Intervention components were delivered through two primary methods including an organization-wide Safety Stand-down training day and the dissemination of a book of best practices. Data were collected through two instruments and the results from each collection effort are described below.

Safety Stand-down Feedback

A total of 292 RWFT flight instructor employees, teaching in all aircraft, participated in the stand-down training. Of those 292, 250 provided feedback (85% response rate) and of the 250 feedback forms received, 27 were incomplete. Subsequently, 223 responses were evaluated. The process evaluation indicators, as well as the results for the first evaluation question, are discussed below.

Process evaluation indicators. Process evaluation indicators included the quality of materials, engagement of attendees, and the preparedness of facilitators. Based on the preponderance of feedback indicating that the participants were either satisfied or very satisfied with the training materials (91%), the subject matter knowledge of the speakers (96%), and the overall quality of the seminar (88%), it appears that the process by which the intervention was delivered was acceptable (see Table 7 below). Additionally, since respondents indicated that the Safety Stand-down experience overwhelmingly met their expectations (92% indicating that it did), it appears that the activities associated with the intervention met the objectives in terms of what was done and how well it was done, suggesting acceptable implementation.

Table 7. *Safety Stand-Down Satisfaction Feedback*

How satisfied are you with:	**Not satisfied [1]**	**Somewhat Satisfied [2]**	**Satisfied [3]**	**Very Satisfied [4]**	***M***	***SD***
The relevance of information to your needs	5 (2.2%)	48 (21.5%)	120 (53.8%)	50 (22.4%)	2.97	.73
Subject matter knowledge of the speakers	1 (0.4%)	9 (4.0%)	103 (46.2%)	110 (49.3%)	3.45	.60
Training materials / slides	2 (0.9%)	18 (8.0%)	129 (57.8%)	74 (33.2%)	3.23	.69
The overall quality of the seminar	3 (1.3%)	24 (10.8%)	123 (55.2%)	73 (32.7%)	3.192	.672

Evaluation question #1. The first evaluation question examined whether or not the intervention affected participant knowledge about non-technical skills and it was hypothesized that there would be a statistically significant increase in knowledge about these skills as a result of the intervention. This hypothesis was supported. Specifically, demonstrated through paired samples t-test procedures, instructors' understanding of the contemporary conceptualization of airmanship significantly increased following the seminar ($M = 3.75$, $SD = .73$) as compared to before the seminar ($M = 3.47$, $SD = .82$), $t(223) = -7.34$, $p < .001$, $d = .72$. Likewise, instructors' knowledge of how observational learning may promote airmanship development significantly increased following the seminar ($M = 3.81$, $SD = .78$) as compared to before the seminar ($M = 3.42$, $SD = .82$), $t(223) = -8.99$, $p < .001$, $d = .93$. Finally, instructors' understanding of the need for best practices in flight training increased following the seminar ($M = 4.08$, $SD = .79$) as compared to before the seminar ($M = 3.85$, $SD = .79$), $t(223) = -5.38$, $p < .001$, $d = .82$.

Intervention Survey Instrument

A total of 194 RWFT's flight instructors, teaching in only the UH-72, were eligible for participation ($N = 194$). Of these, 109 completed the survey instrument (response rate of 56%), but 15 were not useable due to missing data. As a result, the final sample consisted of 94 participants. Of these, 80 (85.1%) were former military rotary wing aviators. The mean total flight experience in technically advanced aircraft was 2902 flight hours ($SD = 3043$, range = 85 – 17,000). The mean total flight instructor experience in any aircraft was 6031 flight hours ($SD = 4516$, range = 600 – 24,000). The mean total time teaching IERW was 9.6 years ($SD = 8.3$, range = 1 – 33 years). Descriptive results for the teacher self-efficacy scales, the learning organization scales, and the perceived organizational support scales are discussed below.

Teacher self-efficacy and evaluation question #2. Exhibiting acceptable overall scale reliability (Cronbach's $\alpha = .72$), results indicated that flight instructors exhibited a generally positive level of teaching efficacy and that personal teaching efficacy was slightly higher than general teaching efficacy, as shown in Table 8 below.

Table 8. *Teacher Self-Efficacy Scale Scores*

TEACHER SELF-EFFICACY	**Total Sample (n = 94) *M***	**Total Sample (n = 94) *SD***
Teacher Self Efficacy (Overall)	3.36	0.56
Personal Teaching Efficacy Subscale	3.56	0.48
General Teaching Efficacy Subscale	3.17	0.64

The second evaluation question examined whether or not the intervention affected participant teacher self-efficacy and it was hypothesized that there would be a statistically significant increase in teacher self-efficacy as a result of the intervention, compared to the normative values of teacher self-efficacy established during the needs assessment (e.g., overall teacher self-efficacy, $\mu = 3.39$; personal teaching efficacy, $\mu = 3.61$; and general teaching efficacy, $\mu = 3.21$). This hypothesis was not supported. One sample t-test procedures indicated that teacher self-efficacy overall did not significantly increase statistically as a result of the intervention, $t(93) = -.986$, $p = .327$, that personal teaching efficacy did not significantly increase statistically as a result of the intervention, $t(93) = -.798$, $p = .427$, and that general teaching efficacy did not significantly increase statistically as a result of the intervention, $t(93) = -.663$, $p = .509$.

Learning organization and evaluation question #3. Reliabilities for learning organization scales were acceptable (Cronbach's $\alpha = .78$ for concrete learning practices and processes, .71 for leadership that reinforces learning, and .80 for supportive learning environment). Results indicated, as shown in Table 9 below, that flight instructors generally felt that RWFT functioned as a learning organization, although it appeared that they felt stronger agreement about having leadership that reinforces learning than either having a supportive learning environment or the organization's use of concrete learning practices and processes.

Table 9. *Learning Organization Scale Scores*

LEARNING ORGANIZATION SCALE	**Total Sample (*n* = 94) *M***	**Total Sample (*n* = 94) *SD***
Learning Organization (Overall)	3.24	0.48
Concrete Learning Practices and Processes Subscale	3.00	0.54
Supportive Learning Environment Subscale	3.20	0.56
Leadership the Reinforces Learning Subscale	3.78	0.74

The third evaluation question examined whether or not the intervention affected participant perceptions about whether RWFT functioned as a learning organization and it was hypothesized that there would be a statistically significant increase in perceptions of learning organization functioning as a result of the intervention, compared to the normative values of learning organization subscales established during the needs assessment (e.g., overall learning organization overall, $\mu = 3.18$; concrete practices and process, $\mu = 2.86$; supportive learning environment, $\mu = 3.24$; leadership that reinforces learning, $\mu = 3.71$). Collectively, this hypothesis was not supported, but concrete learning practices and processes scores did significantly increase. One sample t-test procedures indicated that concrete learning practices and processes significantly increased statistically, $t(93) = 2.435$, $p = .017$, while supportive learning environment, $t(92) = -.343$, $p = .732$, and leadership that reinforces learning, $t(91) = 1.981$, $p = .051$, did not.

Perceived organizational support (POS) and evaluation question #4. The POS scale demonstrated high reliability (Cronbach's $\alpha = .92$). The overall POS scale score of the sample ($M = 3.18$, $SD = 0.74$) suggested that the flight instructors generally felt, although not strongly, that RWFT valued their contributions to organizational success and that RWFT cared about their well-being. See Figure 7 below for Perceived Organization Support histogram.

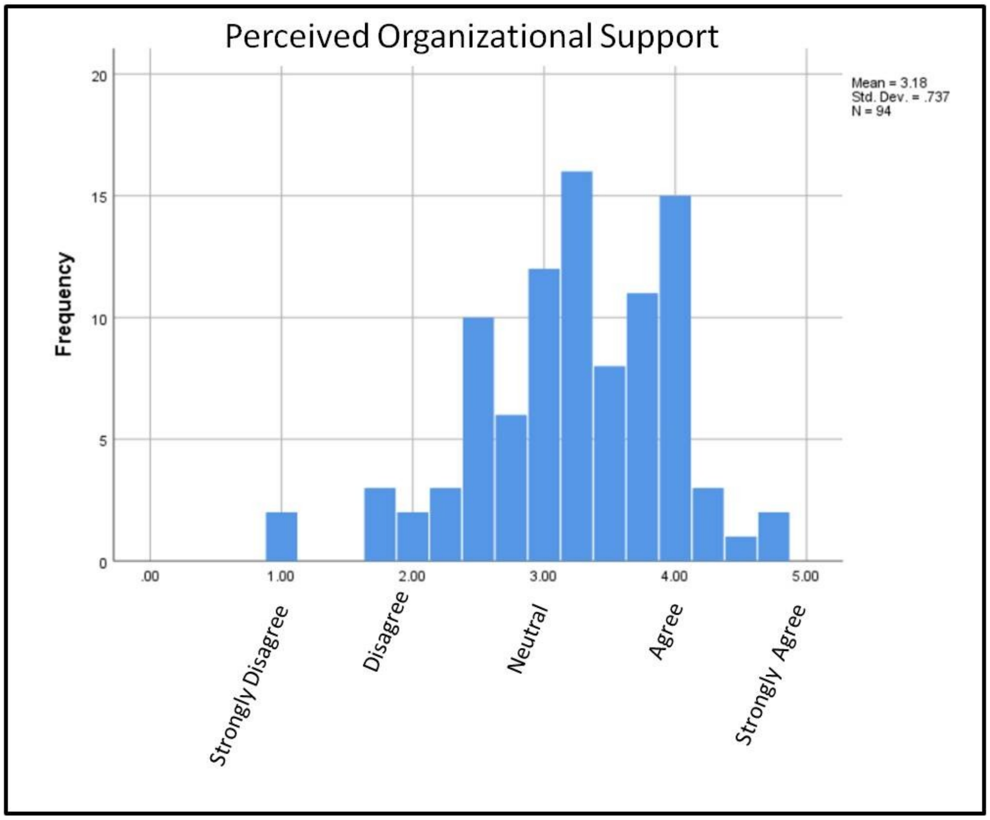

Figure 7. Histogram Showing Sample Perceived Organizational Support

The fourth evaluation question examined the participants' perceptions of Perceived Organizational Support (POS) and whether any of the study's variable contributed to its prediction. Through the hierarchical linear regression procedure, it was possible to determine how well flight instructors' POS could be predicted from demographic variables (e.g., flight experience in TAA, total instructor experience, years as an initial entry flight instructor, and military rotary wing experience), learning organization variables (e.g., concrete learning practices and processes, supportive learning environment, and leadership that reinforces learning), and teaching efficacy variables (e.g., personal teaching efficacy and general teaching efficacy).

The prediction of flight instructors' POS was significantly improved by learning organization functioning (R^2 = .465, adjusted R^2 = .428), $F(3, 87) = 23.63$, p <.001. With this, it appears that the functioning of RWFT as a learning organization is a better predictor of POS than either flight experience or teaching efficacy. Among the learning organization variables, supportive learning environment contributed most. The results of this hierarchical linear regression model are shown in Table 10 below.

Table 10. *Hierarchical Linear Regression Analysis for Predicting POS*

Predictor	*B*	*SE B*	β
Step 1			
TAA Experience	-.001	.000	-.135
Instructor Experience	.001	.000	.067
Years Teaching IERW	-.015	.012	-.173
Step 2			
TAA Experience	-.001	.000	-.080
Instructor Experience	.001	.000	.097
Years Teaching IERW	-.011	.009	-.122
Concrete Learning Practices and Processes	.271	.156	.198
Supportive Learning Environment	.513	.157	.400*
Leadership that Reinforces Learning	.225	.136	.162
Step 3			
TAA Experience	-.001	.000	-.125
Instructor Experience	.001	.000	.106
Years Teaching IERW	-.013	.010	-.142
Concrete Learning Practices and Processes	.285	.167	.208
Supportive Learning Environment	.414	.161	.323*
Leadership that Reinforces Learning	.255	.134	.183
Personal Teaching Efficacy	-.283	.143	-.184
General Teaching Efficacy	.197	.122	.172

Note. N = 94. * p < .05

Discussion

To reiterate, the intervention was theorized to increase flight instructor knowledge and awareness of non-technical aircraft automation management skills while, simultaneously, improving their perceptions of RWFT as an organization that provides opportunities to learn and that supports them as flight instructors and as employees. The extent to which flight instructors responded to the organizational efforts were, however, a function of how those efforts specifically affected them, for better or for worse, because in all cases, change requires that they must adapt to new operational demands (Honig, 2006).

Collectively, the results suggested that the training delivered during the Safety stand-down was powerful for RWFT flight instructors in terms of knowledge, yielding statistically significant results. For each of the topics, the magnitude of change demonstrated through effect size ranged from moderate to large. These effects suggest that the training was valuable, at least in the short-term. According to Newcomer and Conger (2010), however, it is important to distinguish statistical significance from practical importance, and, therefore, when presenting evidence to support a decision, the practical importance of the results should be the focus. In other words, it is not enough to state that there were statistically significant increases in knowledge as a result of the seminars. Instead, data must be meaningful to those who are poised to make decisions through its use (Mandinach, 2012), and decision-makers must be able to not only select the interventions that will improve performance, but also be able to factor in cultural contexts associated with the system (Mourshed et al., 2010). Since flight instructors indicated that the Safety Stand-down experience overwhelmingly met their expectations and that their knowledge increased as a result of the experience, the practical importance of the information to the flight instructors appears evident. Whether or not the dissemination of the book of best practices to the UH-72 flight instructors had a similar effect, however, remains unclear.

Despite the positive results in terms of knowledge increase, there was relatively little effect on the organizational outcome variables or on the teacher efficacy variables. Although results indicated that there was a statistically significant increase in RWFT's use of concrete learning practices and processes, there was no statistically significant change in creating a supportive learning environment or in ensuring that leadership reinforced learning. Similarly, neither personal teaching efficacy nor general teaching efficacy exhibited statistically significant increases as a result of the intervention. Finally, while flight instructors appeared to generally exhibit positive perceptions of RWFT's support of them as employees, only a supportive learning environment appeared to contribute to their sense of perceived organizational support. Since the supportive learning environment scale scores actually decreased, albeit not significantly, it would appear that RWFT could do more to encourage innovation and reflection (Garvin et al., 2008).

Based on multiple sources of turbulence that affected the organization, however, it also appears that RWFT weathered the storm, despite the modest results. According to Boyne and Meier (2009), adverse changes to organizational performance will often accompany unpredictable changes to external environment. In this case, change was completely unpredictable and unexpected and, therefore, it could be expected that adverse consequences would emerge. For example, trust and perceived organizational support are significantly related (Eisenberger et al., 1986), but organizational turbulence will often destroy an employee's trust in management and the organization (Lines, Selart, Espedal & Johansen, 2005). To combat this potential loss of trust, open communication and involvement in the change process are essential (Morgan & Zeffane, 2003).

Since a primary aspect of leadership that reinforces learning (the highest level of agreement among the learning organization sub-scales) involves maintaining open lines of communication with employees (Garvin et al., 2008), this may have helped control the corrosive aspects of the organization turbulence faced by RWFT and its flight instructors. Likewise, concrete learning practices and processes increased in a statistically significant way, suggesting that RWFT management either built or maintained employee trust throughout the upheaval since these practices imply enabling employees to participate in activities that foster collaboration, both internally and externally (Garvin et al., 2008). Nonetheless, these results suggest that there is more work to do to ensure that RWFT's employees are not just prepared to teach but are able to enjoy their time teaching.

Successful change agents are often able to shape the narrative and focus on a specific problem as opposed to an ambiguous goal (McDonnell & Weatherford, 2014). In this case, RWFT's organizational efforts were proximally focused on providing flight instructors information that may influence how they approached their work and it was postulated that these efforts would cascade distally into positive perceptions about RWFT. The linkage of these efforts, however, was certainly more associated with an ideological goal as opposed to a concrete problem. In spite of this, the overarching focus of the intervention appears to have been successful.

Implications

Although organizations often cannot control whether the external environment creates turbulence, they can mitigate its effects by forming networks of actors in other organizations upon which they depend for resources (Boyne & Meier, 2009). According to McDonnell and Weatherford (2014), these networks are invaluable for transmitting data, ensuring that the data informs potential policy change discourse. Further, these networks should include multiple stakeholders and should be maintained in order to ensure that all stakeholders remain part of the conversation, regardless of their agendas (McDonnell & Weatherford, 2014).

While educational systems, and the actors within them, often struggle to identify specific data to be collected (Marsh et al., 2006), RWFT is required to collect multiple types of data as a function of its contract with the government (MICC, 2018). These types include outcome data (e.g., student academic test scores and flight evaluation scores), process data (e.g., daily flight debriefing records and quality assurance inspections), and satisfaction data (e.g., student course critiques), and these records must be made available for review throughout the life of RWFT's contract (MICC, 2018). Originating from quality management processes and continuous improvement initiatives within industry (Marsh et al., 2006), RWFT remains interested in data analysis in order to inform decision-making and potential courses of action (Picciano, 2012).

According to Marsh and colleagues (2006), outcome data are particularly useful when decisions to intervene are necessary. More precisely, the way presenters are able to strategically frame the results of data analyses, and the impacts of adopting decisions based on those results, matter (Park, Daly & Guerra, 2012). According to Park and colleagues (2012), strategic framing involves discussing with stakeholders (1) the nature of the problem (diagnostic framing); (2) the ways in which the problem may be solved (prognostic framing); and (3) the rationale for action (motivating framing). To that end, RWFT, with its three decades of flight training expertise teaching initial entry rotary wing students, is uniquely positioned to recommend changes because it is an organization with a deep understanding of the situation and the expertise to solve problems related to it (Crozier & Friedberg, 1980). With this in mind, it appears that RWFT should communicate both diagnostically about the negative effects that the external environment (e.g., resource constraints, frequently changing syllabi, etc.) is having, and could continue to have, on the flight instructors, and prognostically about how these constraints may be mitigated.

General Limitations

The results suggested that flight instructors gained additional knowledge and awareness of non-technical skills and the importance of social learning theory's contribution to airmanship development. These results, however, must be approached with caution because several significant limitations plagued the study. Most notably, the study focused on a unique flight training organization operating in a unique context and, subsequently, the application of its findings to other organizations is not warranted. Generalizability, therefore, is compromised, even without the study's multiple threats to external validity.

Although the components of the intervention, due to both internal and external issues, were ultimately delivered differently than the ways consistent with professional development best practices, they were delivered nonetheless. While the dynamics of turnaround are complex and not necessarily guaranteed by following an implementation plan that was supported through evidence gleaned from RCTs, the fidelity of this study's implementation is suspect. Even with a strong treatment, its implementation was not in accordance with best practices associated with professional development and, as a result, poor implementation will rarely lead to the intended effects (Leviton & Lipsey, 2007)

According to Lewis (2015), the context in which the implementation occurs remains important because educational improvement is informed by variation and perhaps more than any other issue, the context associated with this study could not be controlled. When researchers can control intervention delivery, the ability to make causal inferences improves, but using multiple comparison groups is even better (Shadish et al., 2002). In this case, limitations on time and resources prohibited the use of multiple comparison groups, and outcomes were analyzed through statistical procedures comparing a normative data to the participant sample. The population of RWFT UH-72 flight instructors has grown by almost 100% since the normative scores were established. Similar to the notion of contamination (Baranaowski & Stables, 2000), prior exposure to the seminar's topic areas may have influenced the ways in which they responded to the intervention.

Although normed comparison contrasts are common in educational studies aiming to determine, for example, if educational organizations improve over time, it is provides little information about the performance of the participants without the treatment and is considered a weak counterfactual (Shadish et al., 2002). In this case, specific threats to validity include selection, history, and maturation. Although the study did use norms gathered on the same population, the rapid change associated with the workforce demographics almost guarantees issues of maturation. Likewise, the many external events that affected RWFT after the initial needs assessment created threats to validity based on history. Although it is possible to mitigate these threats by norming instruments from the same population as the treatment group (Shadish et al., 2002), these threats cannot be ignored.

Finally, the use of self-report ratings to measure perceptions of knowledge gain, teacher self-efficacy, perceptions of learning organization functioning, and perceived organizational support is also problematic. Despite Conway and Lance's (2010) reassurance that the use of self-report is appropriate for perceptions, its use can be considered difficult due to issues of social desirability, consistency motif, and common method variance (Podsakoff & Organ, 1986).

Future Research Directions

Although the results of this study identified that RWFT's flight instructors seemed to benefit from the intervention, it would be beneficial to explore the development of additional topic areas that may also benefit their instruction techniques. While the four content areas forming the focus of this study appear similar (e.g., cockpit workload in technically advanced aircraft and automation monitoring), it may be worthwhile to ensure that the topics are eventually presented in ways that showcase their differences by differentiating the unique features of the each (Dusenbury et al., 2003). To that end, it would likely prove valuable to continue this study through collecting longitudinal qualitative feedback orienting on pedagogical content knowledge and teaching technique. Specifically, consistent with Saeli and colleagues' (2012) method of uncovering pedagogical content knowledge, by identifying flight instructors' specific techniques for determining student understanding or confusion about the non-technical skills, the specific methods they use to teach the skills (if different from those described in the book of best practices), and their particular difficulties with teaching these skills, lessons learned could be packaged and presented to flight instructors on a recurring basis. Additionally, it would be beneficial to identify separate topic areas that could be developed, disseminated, and eventually learned through self-directed study. Finally, with respect to the organization in general, future research should situate on identifying trends that contribute to job satisfaction and trends that contribute to its erosion. By implementing a robust plan for continuous improvement and disseminating findings internally to its workforce and externally to its military customer, RWFT will be poised to ensure that it continues to remain flexible, adaptive, and able to develop within the students it teaches the knowledge, skills, and abilities necessary to fly and survive in today's complex aviation environment.

Appendix 1. Approval to Conduct Research

JOHNS HOPKINS UNIVERSITY

Homewood Institutional Review Board
3400 N. Charles Street
Wyman Park Building, Suite N468
Baltimore MD 21218-2685
410-516-6580
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Michael McCloskey, PhD
IRB Chair

Date: November 5, 2018

PI Name: Christine Eith
Study #: HIRB00007715
Study Name: Developing non-technical aircraft automation management skills: Reconciling the gap in training

Date of Review: 11/5/2018
Date of Approval: 11/5/2018
Expiration Date: 11/4/2019

The above referenced study has been *approved*.

Review Type:	Expedited
Funding Agency:	Not funded
Grant or Contract Number:	
International Sites:	No
Maximum number of participants:	50
Vulnerable populations:	None
Consent process:	Written Informed Consent
Assent Process:	

No changes may be made to the protocol or the consent form without the approval of the

Board. Federal regulations require review of approved research not less than once a year, unless a shorter period is determined by the IRB. Therefore a Continuing Review progress report must be submitted no later than six weeks prior to the Study Expiration date of 11/4/2019 or within 30 days of study completion.

If continuing review approval is not granted before the expiration date of 11/4/2019 approval of this research expires on that date. Failure to submit a Continuing Review Progress Report prior to the approval lapse date will result in termination of the study, at which point new participants may not be enrolled and currently enrolled participants must discontinue participation in the study. All ongoing research activities must stop immediately, including data analysis.

Please keep in mind that it is your responsibility to inform the HIRB of any adverse consequences to participants that occur in the course of the study, as well as any complaints from participants regarding the research. In conducting this research, you are required to follow the requirements listed in the *HIRB Policies and Procedures Manual.*

The consent and recruitment documents have been approved and stamped. These are accessible via the Stamped Documents tab on the New Application Workspace.

Approved Documents:

Written Consents:
Informed Consent (Consolidated)-2.docx

Recruiting Materials:
Recruitment Materials (Announcement Script).docx
Recruiting Advertisement (Corrected).pdf

Study Team Members:
Todd Marshburn

APPROVAL IS GRANTED UNDER THE TERMS OF **FWA00005834** FEDERAL-WIDE ASSURANCE OF COMPLIANCE WITH DHHS REGULATIONS FOR PROTECTION OF HUMAN RESEARCH SUBJECTS

Appendix 2. Safety Stand-down Feedback Form

Safety Stand-down Seminar

Part 1. Please circle the appropriate number as it reflects your level of satisfaction for the following 4 items.

How satisfied are you with:	Not satisfied	Somewhat Satisfied	Satisfied	Very Satisfied
The relevance of information to your needs	1	2	3	4
Subject matter knowledge of the speakers	1	2	3	4
Training materials / slides	1	2	3	4
The overall quality of the seminar	1	2	3	4

Part 2. Please circle the appropriate number to indicate your level of knowledge about the following topics before and after completing the program, using the following key for rating:

1. Very Low — Don't know anything about this topic
2. Low — Know very little about this topic
3. Moderate — Know about this topic generally, but there are more things to learn
4. High — Have good knowledge, but there are some things to learn
5. Very High — Know almost everything about this topic

	Before the Seminar					After the Seminar				
How do you rate your knowledge about:	Very Low	Low	Moderate	High	Very High	Very Low	Low	Moderate	High	Very High
Current conceptualization of airmanship in today's aviation industry	1	2	3	4	5	1	2	3	4	5
The ways in which observational learning may promote airmanship development	1	2	3	4	5	1	2	3	4	5
The need for best practices in flight training	1	2	3	4	5	1	2	3	4	5
Current trends in IERW student performance	1	2	3	4	5	1	2	3	4	5
Generational difference in learning styles	1	2	3	4	5	1	2	3	4	5

Did the Safety Stand-down meet your expectation? 1. Yes 2. No

What future topics or items would you like to discuss in the future? Please indicate below.

Appendix 3. Intervention Survey Instrument

UH-72A FLIGHT INSTRUCTOR SURVEY

PART I: Please answer the following questions in the space provided:

Question	Response
1. Total Flight Experience in Technically Advanced Aircraft (e.g., Glass cockpit, dual engine, automated flight controls) in terms of **total flight hours**	
2. Total flight instructor experience in any aircraft in **total flight hours**	
3. Were you a former military rotary wing pilot **[Yes / No]**	
4. Total experience teaching within the Initial Entry Rotary Wing course in terms of **years and months**	

PART II. Using the scale below, please place a checkmark (✔) for the response that best reflects your level of agreement for each item.

QUESTION	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I can teach even the most difficult students (PTE)	○	○	○	○	○
2. I believe that an instructor cannot really do much since most student's motivation and performance depends on their environment (GTE)	○	○	○	○	○
3. If my students do not remember the information that I provided them previously, then I would know how to increase their retention (PTE)	○	○	○	○	○
4. I can influence decisions about the curriculum (GTE)	○	○	○	○	○
5. I am able to increase students' memory of what they have been taught previously (PTE)	○	○	○	○	○
6. I can teach effectively with the resources I am given (GTE)	○	○	○	○	○
7. The curriculum affords me sufficient opportunity to teach my students what really matters (GTE)	○	○	○	○	○
8. I make fewer errors in the UH-72 than I did in the older aircraft in which I taught (PTE)	○	○	○	○	○
9. I am unable to teach students how to manually fly since the aircraft relies on automation (GTE)	○	○	○	○	○
10. The Company values my contribution to its well-being	○	○	○	○	○
11R.The Company fails to appreciate any extra effort from me	○	○	○	○	○
12R.The Company would ignore any complaint from me	○	○	○	○	○
13. The Company really cares about my well-being	○	○	○	○	○
14R.Even if I did the best job possible, the Company would fail to notice	○	○	○	○	○
15. The Company cares about my general satisfaction at work	○	○	○	○	○
16R.The Company shows very little concern for me	○	○	○	○	○
17. The Company takes pride in my accomplishments at work	○	○	○	○	○
18. My organization evaluates its results against its goals (LPP)	○	○	○	○	○
19. My organization engages and collaborates with its stakeholders (LPP)	○	○	○	○	○
20. My organization seeks ideas and input from students (LPP)	○	○	○	○	○
21. At my work, we maintain open lines of communication (LRL)	○	○	○	○	○
22. Newly hired employees receive adequate training (LPP)	○	○	○	○	○
23. Management invites input from others in discussions (LRL)	○	○	○	○	○
24. My supervisor acknowledges their limitation with respect to knowledge, information, or expertise (LRL)	○	○	○	○	○

QUESTION	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
25. My supervisor encourages multiple points of view (LRL)	○	○	○	○	○
26. At my work, we have forums for meeting with and learning from experts external to the organization (LPP)	○	○	○	○	○
27. At my work, we quickly and accurately communicate new knowledge to key decision-makers (LPP)	○	○	○	○	○
28. At my work, time is made available for education and training (LPP)	○	○	○	○	○
29. As an organization, people are interested in better ways of doing things (SLE)	○	○	○	○	○
30R. People at my work are overly stressed (SLE)	○	○	○	○	○
31. My organization frequently experiments with new ways of working (LPP)	○	○	○	○	○
32. At my work, there is sufficient time for reflection (SLE)	○	○	○	○	○
33. Despite the workload, we find the time to review how the work is going (SLE)	○	○	○	○	○
34. At my work, we frequently compare our performance to that of best-in-class organizations (LPP)	○	○	○	○	○
35. At my work, people are eager to share information about what does and doesn't work (SLE)	○	○	○	○	○
36. Unless an opinion is consistent with what most people in the organization believe, it won't be valued (SLE)	○	○	○	○	○
37. At my work, organizational policies do not restrict innovation (SLE)	○	○	○	○	○
38. I am expected to manage my own learning (LRL)	○	○	○	○	○
39. At my work, people help one another without being told to do so (SLE)	○	○	○	○	○

NOTE: The above items were adapted from the following sources:

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Appendix 4. Process Evaluation Data Collection Matrix

Data Collection Matrix (Process Evaluation)

Process Evaluation Indicator	Data Source(s)	Data Collection Tools	Frequency	Responsibility
Quality of Materials	Safety Stand-down attendees	Safety Stand-down feedback form	Collected the week following the stand-down	Director of Quality
Engagement in Seminar Content	Safety Stand-down attendees	Safety Stand-down feedback form	Collected the week following the stand-down	Director of Quality
Preparedness of the Facilitators	Safety Stand-down attendees	Safety Stand-down feedback form	Collected the week following the stand-down	Director of Quality

Appendix 5. Outcome Evaluation Data Collection Matrix

Data Collection Matrix (Outcome Evaluation)

Outcome Evaluation	Research Question	Data Source(s)	Data Collection Tools	Frequency	Responsibility
Knowledge about Non-technical Skills	RQ1	Safety Stand-down attendees	Safety Stand-down feedback form	Collected the week following the stand-down	Director of Quality
Teacher Efficacy	RQ2	Participants	Intervention Survey Instrument	One-time administration of survey instrument	Human Resources
Perception of Learning Organization Functioning	RQ3	Participants	Intervention Survey Instrument	One-time administration of survey instrument	Human Resources
Perception of Organizational Support	RQ4	Participants	Intervention Survey Instrument	One-time administration of survey instrument	Human Resources

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BIOGRAPHICAL PROFILE

Todd Herron Marshburn was born August 4, 1971 in Fort Wayne, Indiana. He graduated from the United States Military Academy at West Point, New York with a Bachelor of Science degree in Mathematical Economics in 1994. For the next two decades, Todd had the honor and privilege to serve as a military leader, aviator, and scholar in multiple assignments in multiple locations including the continental United States, the Middle East, Central and South America, and Asia. Although commanding several aviation organizations during his military career, he was privileged to also serve as an Instructor and as an Assistant Professor within West Point's Department of Behavioral Sciences and Leadership, where he taught general psychology, developmental psychology, counseling, and the colloquium in psychology for the Academy's psychology students. Later, he served as the Professor of Military Science at the Georgia Institute of Technology, teaching courses in adaptive leadership while providing executive leadership to the Army's Reserve Officer Training Corps program there.

Todd is a retired master Army aviator, instructor pilot, and former commander of the Army's flight training organization responsible for initial entry and graduate flight training. Retiring from the military in 2015, Todd entered the corporate sector, first serving as an instructor pilot, then as Director of Training, and, since April 2017, as the organizational leader for the flight training organization herein referred to as RWFT. In addition to his undergraduate schooling, Todd earned Education Specialist and Master of Science degrees from the Florida State University in 2003, a Master of Military Arts and Science degree from the Army's Command and General Staff College in Fort Leavenworth, Kansas in 2007, and a Doctor of Education degree in Entrepreneurial Leadership in Education from Johns Hopkins University in 2019. He has maintained a certification as a National Certified Counselor (NCC) since 2005.